KNITTING

Its Products and Processes

JESSIE F. CAPLIN

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A Concise Survey of Knit Goods Manufacture
From the Raw Material to the Finished
Merchandise

BY
JESSIE F. CAPLIN

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PREFACE

While there exist a number of excellent technical books relating to the knitting industry, and a few books of a more popular nature have been published in England, this book by Miss Caplin is, as far as I know, the first attempt from the viewpoint of the American market to present this subject to the layman in a brief, simple and comprehensive form.

In the course of a comparatively few pages Miss Caplin surveys the various raw materials and mechanical processes employed in the manufacture of knit underwear, hosiery and other knitted articles, besides giving a good deal of information that would help the non-technical reader to distinguish between different kinds and qualities of knitted merchandise. For educational purposes the book is made still more valuable by the addition of a summary and quiz at the end of each chapter.

I think the book should be extremely useful to the educational departments of large stores, to the home economics departments of educational institutions, to individual students in or out of the store, and to any other person who needs or wishes to have a knowledge of knit goods.

W. D. DARBY,
Market Editor, Dry Goods Economist.

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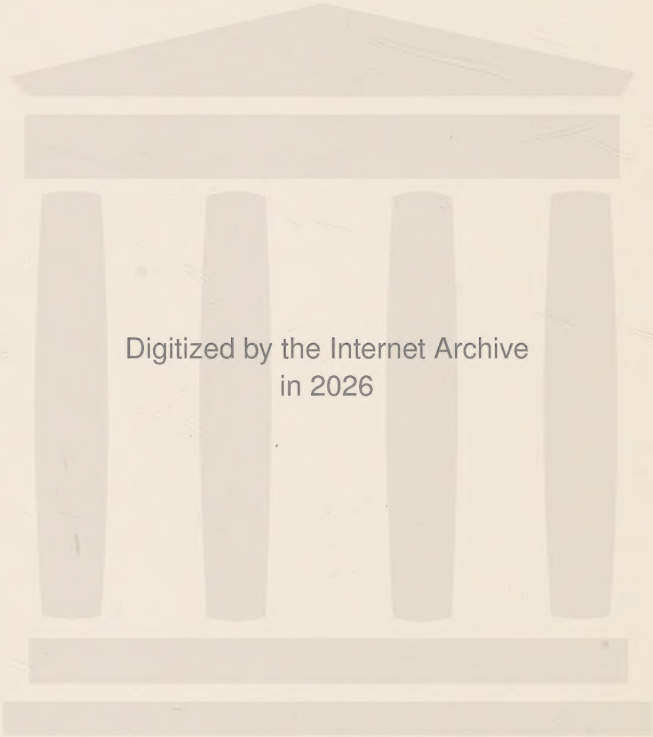
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KNITTING: ITS PRODUCTS AND PROCESSES

CHAPTER I

Characteristics of Knit Fabrics

The unquestioned history of knitting begins five hundred years ago, when definite reference is made to it in English literature and also in Acts of Parliament. Felkin (History of Machine Wrought Hosiery and Lace, p. 16) give quotations to prove that knit hose were being made in 1461. He says that knit woolen caps were mentioned in legislation of 1488 (but these being easier to fashion must have preceded hosiery); petticoats were being knit in 1552, also gloves and sleeves. Knitting in silk was so much more difficult than knitting in the coarser wool that the presentation of a pair of silk stockings to Queen Elizabeth was considered a notable event. The invention of the knitting machine is ascribed to the Rev. William Lee in 1589. It is said to have made stockings ten times as fast as when knit by hand. The speed with which the "machine" worked was one reason given for denying Lee a patent—Queen Elizabeth said that she was afraid of depriving the hand knitters of employment.

Lee's machine made knit fabric on a straight "frame" giving a flat web as in weaving; it had two selvages to be sewed together. In the more than three

hundred years since Lee's death, other workers improved the original device and have added to it power drive and automatic control, until now tubular as well as flat knit fabrics can be made very rapidly.

Outside of the development of the machine itself, there are three factors which have contributed to the present widespread use of knit fabrics; they are—

(1) The fulling (shrinking) of machine knit woolen fabrics gives them some of the firmness of woven cloth, and the napping (roughening) of the surface conceals the looped construction. This gives an inexpensive and satisfactory material for outer garments.

(2) The development of an improved quality of rayon gives to the knitting industry a new and desirable yarn.

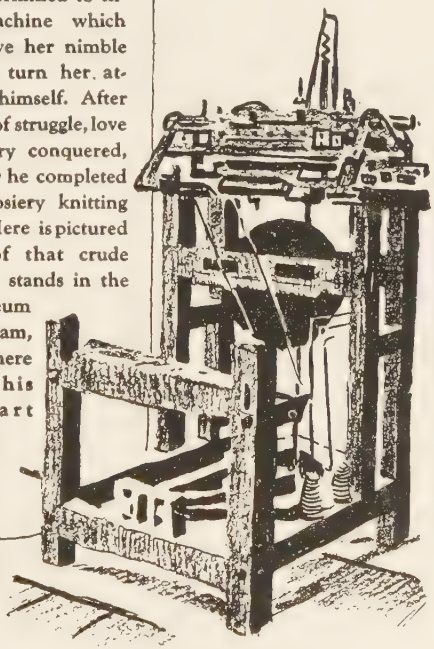
(3) The use of warp knitting, as in glove silk, gives a firm fabric which can be substituted for thin woven cotton, silk, and linen as material for use in lingerie.

Because of the ingenuity of inventors and the vision of manufacturers we find "knit goods" spreading from the hosiery and underwear departments into many sections of the store:—sweaters, sports wear, men's furnishings, notions, corsets, lingerie, infants' wear, gloves, dress accessories, utility clothes for men and women, domestics.

Advantages.—(1) Knit fabrics are *elastic.* Elasticity is the most valuable characteristic of knit fabrics. They stretch and give because of the looped construction (which distinguishes them from woven materials). Strain is distributed as a garment is put on or taken off and during body movements. Knit garments fit without wrinkles which might press and hurt in underwear, or mar the appearance in outerwear. The elasticity accounts also for the *durability* of knit fabrics.

WHEN his shy sweet heart took refuge behind the barrier of her hosiery knitting needles every evening, William Lee, a Cambridge University student, determined to invent a machine which would relieve her nimble fingers and turn her attention to himself. After three years of struggle, love and industry conquered, and in 1589 he completed the first hosiery knitting machine. Here is pictured a model of that crude machine. It stands in the Castle Museum at Nottingham, England, where Lee and his sweetheart lived.

The First HOSIERY MACHINE



From an advertisement of the Triumph Hosiery Mills, Inc., *Dry Goods Economist*, May 2, 1925

(2) Knit fabrics are *absorbent.* The ability of knit materials to *absorb* moisture is due to the looped construction and to the use of loose spun yarn; the loose spinning also makes the fabric soft to the touch—*comfortable.*

(3) Knit fabrics are *economical.* Two factors tend to make a lower proportionate cost for knit materials than for woven fabrics. They are—

a. The knitting machine can use to advantage a more loosely spun yarn and a lower grade yarn than can be used in the loom.

b. Knitting is a more rapid process than weaving; Dooley (Textiles, p. 17) says that seven yards of cloth can be knit in the time that it takes to weave one yard.

(4) Knit fabrics are *adaptable.* They can be made thick or thin, open or close in texture, plain or figured, rough or smooth.

Disadvantages.—(1) The looped construction allows drop-stitching.

(2) Knit fabrics are hard to handle in sewing.

(3) Knit garments tend to sag and stretch and lose their shape.

(4) Knit outer garments are not considered dressy. They tend to cling to the figure and are usually not desirable for the larger woman.

Manufacturers are devising means to eliminate, or at least decrease, the effect of these bad features.

Summary.—Uses of knit fabrics—hosiery; underwear, lingerie, corsets; notions; bathing suits; outerwear (sweaters, dresses, suits, overcoats); accessories (handkerchiefs, neckties, mittens, gloves, scarfs); household (face cloths, towels); mufflers; infants' wear; floor cloths, dust cloths.

Advantages—soft; elastic—improves fit, increases comfort, decreases wrinkles, decreases pressure; low-priced—quickly made, can use low-grade yarn; durable; easily washed, need not be ironed; absorbent—sanitary; looped texture holds air, keeps in body warmth, but ventilates the skin.

Disadvantages—stretches and sags; clings to the figure; drop-stitches; hard to handle in sewing.

The most practical material in this chapter is given in the paragraphs on "advantages" and "disadvantages" of knit goods. The facts stated there can be applied in buying when there is a choice between a woven and a knitted fabric. Vice versa, in selling knit goods, one may emphasize the advantages and minimize the disadvantages.

CHAPTER II

Wool for Knitting

Introduction.—Wool was a textile fiber easily available in early times. It was always recognized as a valuable means of protection against dampness, cold, and sudden changes of temperature. It was the easiest fiber to handle, for the fibers, having a natural crimp, held together during the more or less primitive spinning process. The making of wool yarn was a common home industry. Wool yarn was the first to be used for hand knitting and was also the first to be used in Lee's machine.

In the Northwest one can still find farm-houses in which, using wool from sheep raised on the farm, the housewife handles it in a fashion centuries old. She sorts and washes it, dyes it, cards it, combs it with her fingers, and spins it. Then she knits it into socks, sweaters, mittens, and mufflers. These processes have been developed on a large scale for use in mills.

Knitted wool for undergarments is required only by athletes and those who work out of doors, but knitted wool for outer clothes is in great demand. The wool sweater, which can be put on and taken off as desired, meets many present-day requirements. The vogue of sports has increased the demand for wool hosiery. Knit wool overcoats for men, ladies' suits, and dresses are attractive as well as practical.

Kinds of Wool.—Wool is more used today than any

textile fiber except cotton. Most of the wool consumed in the United States comes from domestic sheep bred especially for the purpose; the balance is imported from Australia, New Zealand, South Africa and South America. Camel's hair, mohair and alpaca help fill the demand for novelties.

The wool of the merino sheep brings the highest price. Merino staple (fiber) is fine and lustrous. It is about two inches long and has a fine crimp. The length and the crimp together make this wool easy to spin, its fine fiber produces a soft fabric, and the luster gives the product a particularly attractive appearance.

Merino is the standard by which wool is judged. Low grade wools are coarse, wavy, rather than crimpy, have a less lustrous staple, and make a thick stiff yarn. Comparatively little merino wool is used in the knitting industry. Kinds commonly used are Ohio delaine (very good) and territory wool (of various grades) which comes from the Western States. Grades commonly used are one-half blood and one-quarter blood; these terms indicate how near the wool approaches merino (full blood) in quality.

The National Bank of Commerce gives the following prices of wool per pound on a "clean basis, Boston."

July	1913	1920	1921	1922	1923	1924	1925
Ohio fine delaine	.58	1.74	.83	1.45	1.37	1.30	1.35
Ohio ¼ blood ...	.42	.79	.40	.76	.84	.79	.90

Fleece Wool and Pulled Wool.—When sheep are sheared, the fibers being held together by their crimp and the natural grease, the wool comes off as one piece, and is called "fleece wool." When sheep are used for meat, the skins are saved to make into leather. The wool is removed from these skins. In one method a

chemical is painted on the flesh side of the skin and allowed to act for twenty-four hours; then the wool can be easily pulled away from the skin. *Pulled wool* is less desirable than fleece wool and brings a lower price.

Sorting.—When the bags of fleece wool reach the mill a sorter takes a fleece and picks out the best part—that around the sides and neck. The rest of the fleece makes

Wool under the microscope shows overlapping scales. The coarser the wool, the further apart are the scales

lower grades. Good wool is soft, fine, and lustrous; it has enough crimp to make it spin easily; it has "life" and elasticity.

Cleaning.—In the mill, after sorting, the wool is *scoured* (washed) in warm soapy water. This process removes the grease and dirt (often up to 70 per cent). The burrs which have caught in the wool as the animal grazed are removed by special process. The larger burrs can be removed by machinery. The broken burrs, scraps of leaves, and twigs, are removed by a *carbonizing* process. In this process the wool is soaked in weak sulphuric acid and then heated. The vegetable matter turns to a black powder which can be dusted

out; the wool, being animal matter, is not affected by this treatment.

Blending.—The wool may be dyed at this stage, that is, *stock dyed* (dyed in the wool). The next step is blending or mixing the fibers.

(1) All mills blend different grades of wool in order to secure a uniform quality. In blending, a part, at least, of what would otherwise be waste is used.

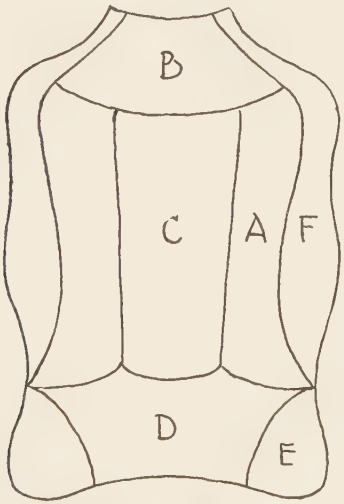


Diagram to show variation in quality of wool depending on the part of the fleece selected. (a) sides is best; (b) near head is second best; (f) under belly is poorest

(2) Sometimes different colored wools are blended in order to secure a particular effect, such as a *heather mixture.*

(3) Cotton and rayon and silk are sometimes blended with wool. A cotton and wool mixture is often called *merino,* but strictly speaking this is an in-

accurate and misleading term, and should be used only to describe a yarn or fabric made from merino wool.

Carding.—The blended wool is fed into carding machines where wire-covered, brush-like cylinders separate the fibers from one another, making a fluffy mass, and finally produce soft thin untwisted strands called *roving.*

Spinning.—When roving is spun (twisted) into a *woolen yarn* there are three distinct processes. First, a length of roving is drawn into a thinner strand, then it is twisted, then wound on a spindle. The more twists there are to the inch, the stronger the yarn.

Characteristics of a Woolen Yarn.—The processes of carding and spinning change the wool fiber into yarn in the quickest and easiest way. The product is called a *woolen* yarn.

(1) The *fibers* lie in the yarn in any and all directions.

(2) The outside of the yarn is *rough* because of the projecting ends of the fibers.

(3) A good woolen yarn is strong and makes a durable garment which is soft and comfortable.

(4) When woolen yarns are used in knitting, the projecting fibers tend to *disguise* the *texture;* they help to *prevent drop-stitching;* they hold an extra layer of air, thus increasing the *warmth* of the article.

Illustrations of knit woolen fabrics are found in wool jersey overcoats for men, low-priced suits for women, and in other garments having a fuzzy (brushed wool) surface.

Bleaching.—If white or delicate shades are desired, the woolen yarn or the fabric must be bleached. There are two methods of bleaching wool:

(1) Expose the wet material to the fumes of burning sulphur.

(2) Soak the material in hydrogen peroxide or in a mixture of sodium peroxide and acid (which makes hydrogen peroxide).

These bleaching agents do not weaken wool. Their effect, however, is not permanent. White wool turns yellow in time, the color change being hastened by exposure to the sun and by washing.

Finishing.—In order to obtain firmness, maximum warmth and the desired finish, knit woolen fabrics are *fulled* or felted and *napped.*

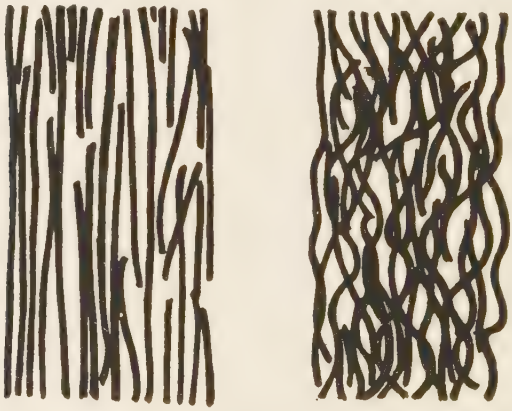
Each wool fiber is covered with scales, microscopic in size. These scales open out under the influence of moisture, alkali (like strong soap), and extremes of temperature. If, under these conditions, the wool is rubbed, the scales interlock and stay interlocked, causing permanent shrinkage. In the fulling or felting process the wet material is soaped and steamed, then pounded to secure the requisite interlocking and the required shrinkage. Fulling makes the wool fabric thicker, closer and firmer.

The purpose of napping is to roughen the surface of the woolen fabric and thus, more or less, hide the looped construction and give the material a softer, warmer, richer appearance. A fabric is napped by means of wire brushes or by means of teazles (burrs).

Making a Worsted Yarn.—A fundamental difference in the appearance and qualities of knitted wool goods depends on whether they are made of woolen or of worsted yarns. The distinction between the two lies in the way the fibers are arranged. In a woolen yarn the fibers lie in all directions, in a worsted yarn they must all be parallel. Worsted yarns require a longer

fiber than woolen yarns; they require more processes in preparation, and their manufacture produces a larger proportion of waste. For these three reasons worsted yarn is more expensive than woolen yarn.

The *combing* process is the distinguishing feature in the manufacture of worsted yarn. It is an additional process which comes after carding. In it the fibers are laid *parallel* to one another. The process can be com-



Left—A worsted yarn has parallel fibers and a smooth surface
Right—A woolen yarn has tangled fibers and a rough surface

pared to combing the hair. The combed wool is called tops, the snarls and short ends which are combed out are called noils. The noils may be combed again or they may be sold to woolen manufacturers.

After the wool is combed it is spun into yarn. Greater strength can be secured by twisting together two or more strands of spun yarn, making a *ply yarn.*

Characteristics of a Worsted Yarn.—Because of the parallel fibers in a worsted yarn, it has a smooth finish

and a luster lacking in a woolen yarn. A worsted knitting yarn can be spun very fine and still be strong. It is usually at least two ply. It makes a smooth, lightweight, clear-textured fabric. Worsted garments are higher in price than woolen garments. They are usually more dressy in appearance and more durable. Knit worsted materials do not require elaborate finishing processes. Worsted yarn is used in making high-grade hosiery and sweaters. It is the yarn used in knitting the balbriggan so much used in 1925 for ladies' and misses' dresses.

The difference in quality of a woolen and worsted fabric is due to the different character of the yarns; the difference in appearance is due to the different finishing processes.

Remanufactured Wool (*Shoddy*). — The careful housewives who knit socks, sweaters, mufflers, and mittens out of wool they had prepared and spun, were not willing to throw a knitted garment away when it was "not worth darning." They raveled it, picked the yarn to pieces, added new wool and spun the mixture into a yarn for reknitting. By this economical practice wool was made to give much longer service than otherwise.

A similar practice is in use in shoddy mills. To the mill come discarded knit wool garments to be raveled and woven wool garments to be torn to pieces and remade into yarn. Knitted wool, particularly worsted, brings a high price at a shoddy mill. The material which comes into a mill is sorted into all-wool and part-wool materials, into woolens and worsteds, and as to color. The materials are then skirted (fastenings and linings removed). In the case of the cotton-wool mixtures, the cotton, which is vegetable matter, is removed by sulphuric acid and heat—the same method that is

used in the carbonizing process for freeing wool from burrs. The wool left after this process is called "extract wool."

The extract wool or the all-wool materials are torn by machinery and separated into a mass of fibers which can be blended with virgin wool (new wool) or cotton.

Qualities of Remanufactured Wool.—Shoddy is wool and has the qualities of wool except as wear has rubbed off the characteristic scales and decreased the felting quality and as the process of manufacture has broken the fibers into short pieces and decreased the elasticity. Fabrics made of remanufactured wool do not have the spring and life which is characteristic of materials made of *virgin wool.* The fibers are liable to be coarse and the yarn lacking in strength. If spun with long staple wool it can make durable and satisfactory fabrics. Remanufactured wool is not used in making typical worsted yarn.

The manufacture and use of shoddy gives a means of conserving wool and of lowering the cost of the finished article. Its presence is hard to prove, but it can be suspected if many short fibers of mixed colors are found in a yarn.

Qualities of the Wool Fiber.—Wool is an animal fiber, as is silk. High grade wool and silk have many qualities in common. The qualities of the fiber determine the qualities of the cloth.

(1) The wool fiber has a *scaly* surface. The scales interlock under the influence of heat, moisture, freezing temperature and rubbing, thus causing *shrinkage.* Long coarse fibers have their scales more widely separated, thus reducing the tendency to shrinkage.

(2) The wool fiber varies in length depending on the kind of sheep and upon the period of time it has been

allowed to grow. Good wool is from two to eight inches long. Shorter fibers are found in low-grade wool and remanufactured wool.

(3) Wool is not a straight fiber. The short fine wools are *crimpy;* the longer coarser wools are *wavy.* The crimp or wave helps spinning and also explains the ability of wool to hold air and make a warm garment. It keeps the fibers from matting.

(4) The wool fiber is *elastic,* therefore, wool fabrics do not wrinkle easily. The springiness of knit wool makes it comfortable under pressure and explains the demand for wool hiking stockings. The crimp in the wool increases the elasticity of the fabric.

(5) Wool is a non-conductor of heat. The crimp in the wool, the loose spinning of the yarn, and the looped texture of the knit fabric hold a layer of air and help to make a knit wool garment a *warm* garment.

(6) Wool is not a particularly strong fiber. The strength of the yarn is increased by twisting, by making a ply yarn, by blending with cotton, and by knitting a cotton yarn with the wool yarn in such a way that the wool is thrown to the surface, cotton to the back (plating).

(7) Wool has more luster than cotton.

(8) Wool fibers vary in size. Fine wool is softer.

(9) Wool can absorb about 50 per cent of its weight of water without feeling wet.

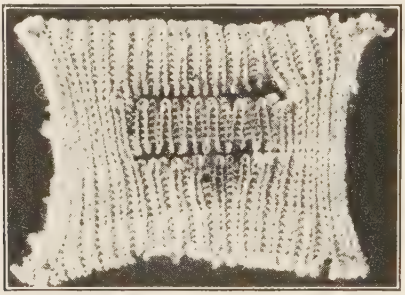
(10) Wool takes and holds dye well.

Tests.—Experts are said to be able to tell by feeling whether there is cotton mixed with wool. Four tests follow.

(1) *Microscope.* A strong microscope (not a magnifying glass) shows the scales of the wool fiber.

(2) *Lye Test.* A sample can be boiled for five minutes in 5 per cent lye solution using a tin or enamel cup. The wool will disappear leaving only the cotton. The method gives the clearest results when the percentage of wool is large.

(3) *Flat Iron Test.* A drop of 2 per cent sulphuric acid is put on the sample, being sure that it penetrates to the back of the fabric. Put the material between the folds of newspaper and press with a hot iron. This is similar in effect to the carbonizing process used in re-



Result of flatiron test. Every eighth thread, which is all cotton, is burned away; also at least half of every other thread

moving burrs from raw wool and in removing cotton from cotton-wool mixture in making shoddy. The cotton turns black and can be removed by gentle rubbing. This test is very satisfactory when the percentage of wool is small.

(4) *Burning Test.* Wool fibers burn slowly and form a knob; the smoke smells like burning feathers. Cotton fibers burn quickly and leave but little residue; the smoke smells like burning paper. This test is not satisfactory if wool and cotton are blended.

Value of Knitted Wool.—The good qualities of wool are strengthened by knitting and its weak qualities tend to disappear. Knit wool makes warm undergarments and hosiery; it makes comfortable, durable, good-looking protective outer-garments. Knit fabrics can use satisfactorily a lower grade of wool than can be used for weaving; therefore the demand for all-wool garments at a low price can be met with knit fabrics. Because of their softness, warmth and elasticity, garments knit of fine wool are desirable for babies.

Care.—The proper care of knitted wool is often indicated on labels attached to the garment by the manufacturer. It is better not to hang up knit garments. Directions for correct laundering are given by the makers of soap products. Expert dry cleaning of outer-garments is recommended.

Novelty Fibers.—(1) *Mohair* is the hair of the Angora goat, an animal which is raised in the United States in large numbers. The fiber is white, fine, long, strong and lustrous. It does not require much preparation or much twisting to produce a fine, smooth yarn. It may be used in its natural color, white, but usually it is dyed. Mohair knits up into attractive sweaters, desirable for their open mesh and light weight. Garments knit of mohair require special care in handling to avoid snagging.

(2) *Alpaca,* the hair of the South American goat by the same name, has many of the characteristics of mohair. It is usually used in its natural brown or black color for making into fine yarns for knitting gauze-like sweaters and scarfs.

(3) *Camel's hair* is the soft tan colored wool of the camel. It makes attractive garments, light in weight but warm. Camel's hair is not abundant, so its use in

knit goods is restricted to high-priced novelties. Sometimes sheep's wool is dyed a tan color and mixed with camel's hair. A label guaranteeing that the material is 100 per cent camel's hair usually accompanies the real article.

Summary.—Kinds of wool—sheep, camel, goat; virgin (fleece or pulled), remanufactured.

Kinds of yarn and manufacture:

Woolen	Worsted
sorting	
scouring	
removing burrs	
dyeing	
blending	
carding	
	combing
spinning	
bleaching	
	dyeing
knitting	

Qualities of wool—non-conducting, elastic, scaly, lustrous, wavy, dyes well.

Tests—microscopic, burning, flat iron, lye.

Technical terms used:

alkali
alpaca
balbriggan
bleaching
blending
brushed wool
one-half blood
camel's hair
carbonizing
carding
clean basis
combing
crimp
delaine
elasticity
extract wool
fleece wool
fulling
grease
heather mixture
luster
merino (two meanings)
mohair
napping
noils
plating

ply yarn
pulled wool
remanufactured wool
roving
scales
scouring
shoddy
skirting
sorting
spinning
staple
teazle
territory wool
tops
virgin wool
woolen
worsted
yarn

Review and Merchandise Applications.—(1) Take each of the technical terms given in the alphabetical list at the end of the summary, define the term and explain its application to wool knitting yarn or wool knit goods. *Watch* for the use of these terms in *advertisements* and *labels.*

(2) When was knitting invented? What was the method of making wool cloth before that time?

(3) What are the advantages of wool for clothing? Which of these advantages may be increased by knitting?

(4) Do you know of any home where you can see carding and spinning done by hand?

(5) Do you know of any wool bathing suits which are not knitted? Explain their use.

(6) Why are woolen bathing suits sometimes not allowed to be used in swimming pools?

(7) Do you know of any cotton bathing suits being sold? Why are they used instead of wool?

(8) What is the range in price in wool bathing suits? Account for it. Clip some advertisements of bathing suits. How is quality indicated?

(9) Sample of wool jersey. Width? Price? Is it knit tubular or with a selvage? Compare it with a

similarly priced woven wool fabric (name) as to desirability.

(10) Examine a camel's hair sweater. How do you know it is camel's hair? What value does the camel's hair give? Name other garments which are knit of camel's hair. Is a camel's hair yarn woolen or worsted?

(11) Can you find an alpaca sweater? What color is it? What are its characteristics? Price?

(12) Examine a mohair sweater. Price? Which of the characteristics named can you verify? Can you find anything else knit of mohair yarn? Is a mohair yarn woolen or worsted?

(13) Name some trade-marked utility garments for men and women made of knit woolen cloth (suits, overcoats, dresses).

(14) Can you find any labels or advertisements of knit goods which state the grade of wool used?

(15) What are the characteristics of high-grade wool? Can you find a knit wool garment which shows these qualities?

(16) What are the characteristics of low-grade wool? Can you find an inexpensive knit garment which shows these qualities?

(17) Make a list of all the qualities which may account for high price in a knit wool garment. Can you use any of these in determining the value of an item?

(18) Make a drawing to illustrate the difference between "crimp" and "wave."

(19) Can you get a sample of raw wool (in the grease)? Do you think it is high or low-grade? What is its most interesting characteristic?

(20) Tell three entirely different practical uses which can be made of the carbonizing process.

(21) Can you find in an art needle-work department a hand knitting yarn which is—

(a) woolen? What are its characteristics? Trade name?

(b) worsted? What are its characteristics? Trade name? How does the price compare with that of the woolen yarn?

(c) blended? What fibers are blended? What colors are blended?

(22) Can you find a discarded knit wool garment? Ravel out a yarn. Is it single or two ply? Pick the yarn to pieces. Was it a woolen or worsted yarn? Were the fibers coarse or fine? Long or short? Uniform in color or mixed? All wool or a mixture?

(23) Examine an athletic sweater. Is it made of coarse or fine yarn? Coarse or fine wool? Try to pull out some fibers; are they long or short? Is it made of woolen or worsted yarn?

(24) Compare the appearance of worsted and woolen hose. How do they compare in price? Explain. Is there a label to show where they are made?

(25) What precautions should be used in washing a knitted wool garment to minimize shrinkage? Did you ever know of a knitted wool garment which stretched? Explain.

(26) Why isn't remanufactured wool made into worsted yarn?

(27) Find in an encyclopedia or a textile book a diagram showing the scaly appearance of the wool fiber. Trace the drawing. Can you have the opportunity of seeing wool fibers under the microscope? Do they look like the picture?

(28) Can you find a discarded knit garment which

you think contains cotton and wool? Apply as many as possible of the tests which were given. Results? Conclusions? Which test do you like best? Least?

(29) Compare wool balbriggan and wool jersey as to price, width, appearance, construction, value.

(30) Current quotations of the price of wool are on a basis of "in the grease" or "scoured." What is the meaning of the terms? Can you find and clip quotation of wool prices in a newspaper?

(31) Besides wool, which of the other textile fibers (cotton, silk, linen, rayon) were available for knitting yarns during the fifteenth and sixteenth centuries?

(32) Compare woolen and worsted yarns and fabrics by filling in the following table:

	Woolen	Worsted
length of fibers	.....	.....
position of fibers	.....	.....
position obtained by	.....	.....
fineness	.....	.....
smoothness	.....	.....
felted?	.....	.....
napped?	.....	.....
dyed when?	.....	.....
texture	.....	.....
durability	.....	.....

CHAPTER III

Silk for Knitting

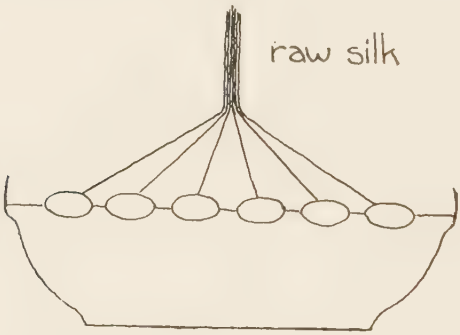
Importance.—Although in quantity silk makes up but a small part of the textile fibers which the world produces in a year, its high price and valuable characteristics give it a very important position. The high wages paid since 1914 have made the beauty and luxury of silk garments available to a new and large group of consumers. Style has emphasized the qualities of silk in such a way as to increase the demand. Manufacturers of hosiery and knit goods are using increasingly large quantities of silk.

Two Types of Silk Knitting Yarns—Spun Silk and Thread Silk.—The industry of raising silk worms and producing silk is carried on chiefly in Japan, China, Italy, France and Syria. Ninety per cent of the silk produced in Japan is imported into the United States, but fills only 75 per cent of our requirements. The silk used in knitting (and weaving) is classified as thread silk (which is higher grade) and spun silk (schappe). Both thread silk and spun silk are real silk.

Reeling—the first step in making Thread Silk.—The silk worm makes a long two-part fiber and a glue-like gum called *sericin* which coats the filaments and holds them together. The silk worm winds the silk fiber around itself, forming the cocoon. The cocoon looks like a peanut shell in size, shape, and thickness. Two per cent of the cocoons are saved for breeding; the

worm in the others is killed by putting the cocoons in a hot oven—it is thus prevented from piercing the cocoon and breaking the silk.

Several cocoons (six is a common number) are soaked in hot water to soften the sericin; the ends of

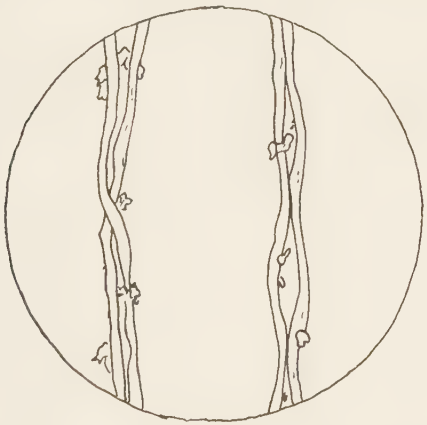


The silk from six cocoons is reeled at the same time to make one strand of raw silk

the (six) two-part filaments are laid side by side and the silk from the cocoons is unwound. As the group of filaments dries, the gum holds them together. The silk strand thus formed is reeled (wound) into skeins and is called reeled silk, or, more commonly, raw silk. Silk is reeled from the cocoons in the country where the silk worms are raised. The work required for the production of raw silk can be done by any one who is patient enough, but it requires much time and care. Although all the work is done by cheap labor, the price per pound of raw silk is twenty times that of cotton. It varies with economic conditions. The average in 1913 was $3.65; because of the war, it rose so that in January, 1920, it was $16.25; it dropped, then rose for

a short time as a result of the Japanese earthquake in 1923; its price in July, 1925, was $6.35. The price at a given time varies with the quality. The best grade of Japanese silk is "grand double extra."

Raw silk is cream colored (sometimes yellow), stiff,



Raw silk under the microscope. The silk worm spins two fibers at once cementing them together with sericin. The dried sericin shows in the drawing

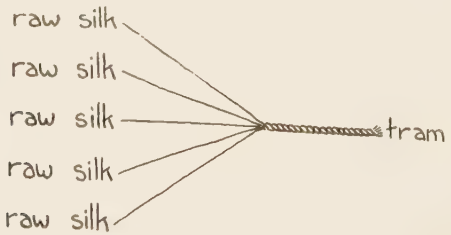
Silk cocoon cut in half to show the average size and thickness; also worm in center

and dull; few people would recognize it as silk. It is this raw silk which is imported by manufacturers and dealers, making the valuable cargo of the silk trains

which are sent rushing across the country at express speed to be stored in reinforced concrete warehouses and guarded there as its value deserves.

Doubling and Throwing—the second step in making Thread Silk.—Raw silk can be used to knit a thin glove —silk fabric. When it is to be used in this way it is first thrown (twisted) to increase the strength. Raw silk which has been twisted is called *singles.*

Raw silk is not heavy enough or strong enough for most knit fabrics. To make the raw silk strands into a heavier yarn they are moistened, doubled (several strands laid side by side) and then twisted. The soft silk yarn which results is called *tram;* it is used in the



Five strands of raw silk twisted together to make tram

knitting industry for hosiery and underwear. Some knitting mills are equipped to do their own doubling and throwing.

The terms 5 strand, 10 strand, 12 strand—so often used in connection with silk hosiery—mean that 5, 10, or 12 strands of raw silk were twisted together to form a tram. The sheerness of a chiffon stocking is obtained by the use of a two to five strand tram, while a heavy duty stocking uses a nine to twelve strand tram.

Amount of Twist.—The twist to be given to tram to be used for knitting varies according to the use to be made of it; from 2½ to 5 turns to the inch is commonly used. Twisting increases the strength but decreases the luster.

Organzine.—If two or more strands of twisted silk (singles or tram) are twisted in the opposite direction, the yarn which results is called organzine. This is used in knitting the heavy fabrics required for some neckties and some sweaters.

Measuring the Heaviness of Silk.—The *denier* is the weight which is used in stating the heaviness of raw silk. The two-part fiber which the silk worm spins is, on the average, 2½ denier. Since the raw silk usually bought for knitting may contain six or seven cocoon fibers, it would be from 13 to 15 denier (written 13/15 denier). A 10 strand tram might be made of 10 strands of 10/12, 13/15, or 14/16 denier silk—the 14/16 silk would make the heavier tram. In other words, the number of strands does not tell the whole story—denier and strands together do.

Bleaching.—If silk is to be dyed light shades or white (really dyed a faint blue) the silk must be bleached. The method is the same as in the case of wool. The process does not hurt or weaken the silk, but light colored silk yellows in time. The yellowing is hurried by sunlight and by the use of strong soap.

Degumming and Dyeing.—The gum (sericin) holds the fibers of silk together in the yarn and makes it easier to work with. It must, however, be removed before the silk is bleached or dyed. Degumming (removing the sericin) is accomplished by boiling the skeins of silk or the knit silk fabrics in soapy water.

Silk, in degumming, loses about 25 per cent of its weight; it becomes white and shows the characteristic luster and softness we associate with it.

Silk may be dyed in the skein (ingrain) or the silk fabric may be dip dyed. Skein dyeing makes it easier for the dye to penetrate and gives a more lustrous product. Dip dyeing enables the manufacturer to make up "gray" stock (in the gum) and then dye it to meet the color demands of style.

Weighting versus Pure Dye.—In order to replace the 25 per cent loss due to degumming, manufacturers have added foreign substances, particularly metal salts, to the silk when dyeing. The demand for heavy silk has caused some manufacturers to add much more than 25 per cent of metal salts; this is called *weighting.* Heavy weighting often lessens the durability of the silk. The metal salts may crystallize and cut the fine fibers; for this reason, weighted silk often weakens as it lies in the box on the dealers' shelves or in the dresser drawer. Silk dyed without weighting is called pure dye silk.

Test for Weighting.—People who handle silk knit goods can often detect excessive weighting by the "feel." A customer should be able to rely on the salesperson's answer to the question, "Is this pure dye?"

The burning test is good for determining the presence or absence of weighting. Silk not excessively weighted will blaze and continue to burn, forming a ball-like mass; if weighted it won't burn with a flame, but will glow and leave a brittle residue, similar in shape and structure to the original yarn or fabric.

Spun Silk (*Schappe*).—This is real silk, but is made from pierced cocoons and other forms of waste which accumulate in the silk industry until the throwing

process is complete. This waste is degummed, cut into short lengths for convenience in handling, combed to make the fibers parallel, then spun (twisted) to give strength. These processes correspond to the methods used in making combed cotton yarn or worsted yarn. Strands of spun silk can be used as "singles" or twisted together and made into ply yarns. There are different grades of spun silk; the best grade has the longest fibers and is the most lustrous. In the lower grades, many fiber ends project and make a fuzzy surface.

Spun silk costs about half as much per pound as tram or organzine and so is often used in goods requiring a large quantity of silk, such as underwear and sweaters. Some underwear manufacturers use thread silk in one grade and spun in a lower priced grade of the same garment. Spun silk is used in silk and wool mixtures.

Advantage of Silk Knit Garments.—If closely knit of good quality silk, and of good weight, silk garments look well, are durable, and launder easily. They pack into small space for traveling, and do not require pressing.

Care.—The directions given for care and laundering by makers of the garment and by soap manufacturers should be carefully followed.

Qualities of the Silk Fiber.—The properties of the fiber determine the properties of the cloth. The following characteristics of silk make it desirable for knit fabrics:

(1) Silk is the longest natural fiber. Single fibers vary in length from 300 to 1200 yards; consequently, silk fabrics do not show the fuzzy surface and many projecting ends which are found, for example, in cotton cloth.

(2) Silk is the strongest fiber. Do you remember that the sword of Damocles was suspended by a silk thread? If you were to try to break yarns of silk, of cotton, of linen, of wool, and of rayon—all of uniform thickness and twist—you would find that it takes the strongest pull to break the silk yarn. Because the silk fibers are so long and so strong, they do not require spinning as the shorter, weaker cotton and wool fibers do. Because the silk fiber is so long and so strong, it can be made into thin fabrics which are durable.

(3) Silk is the smoothest natural fiber; consequently dirt does not cling to silk materials; they stay clean looking a long time, and dirt slips off easily in washing. Silk is the most lustrous natural fiber.

(4) The silk fiber is fine and also elastic; hence silk garments take up little space in packing and do not wrinkle as easily as garments of cotton or linen.

(5) The silk fiber is a non-conductor of heat. Silk fabrics help retain the body heat—a valuable characteristic in winter.

(6) The silk fiber is absorbent. It takes up moisture from the body and gives it to the air, a valuable characteristic in summer.

(7) Silk dyes easily.

Summary.—Kinds of silk: Raw silk (reeled from cocoon); singles (raw silk, twisted); tram (raw silk doubled and twisted); organzine (singles or tram, doubled, and twisted in the opposite direction); thread silk (singles, tram, or organzine); spun silk (made from waste).

Effect of twist: increases strength, decreases luster.

The weight of silk is stated, for raw silk, in denier; for thread silk, in number of ply (and denier); for spun silk, in number of ply (and yarn number).

Degumming, which means loss of 25 per cent, may be done either in the skein or after knitting.

Dyeing:

ingrain (skein dyed)
dip dye (piece dyed)

Weighting (during dyeing):

method
effect on durability
burning test

Qualities: long, strong, smooth, lustrous, elastic, fine, non-conducting, absorbent, dyes readily

Technical terms summarized:

bleaching	in the gum	sericin
burning test	ingrain	singles
degumming	organzine	spun silk
13/15 denier	ply yarn	10 strand
dip dye	pure dye	thread silk
doubling	raw silk	throwing
glove silk	reeled silk	tram
in the gray	schappe	weighting

Review and Merchandise Applications.—Take each of the technical terms given at the end of the summary, define the terms, and explain the application to silk for knitting or silk knit goods. Watch for the use of these terms in advertisements and labels.

(1) What per cent of the world's production of textile fibers is silk?

(2) Can you find and clip the current raw silk quotations from a newspaper?

(3) Examine darning silk and determine the answers to the following questions about it: thread silk or spun silk? ply yarn? weighted?

(4) To illustrate weighting, dip a thread of darning

silk into salt water. Dry. How has it changed in appearance—feeling—weight? Try burning it—how does the result differ from that obtained in burning untreated darning silk?

(5) The effect of twist on strength can be illustrated by using a thread of darning silk; break it. Take another piece and twist it tightly; try to break it. Conclusion.

(6) What kind of silk garment would you choose if you wanted durability—pure dye or weighted?

(7) Test as many pieces of discarded knitted silk garments as possible to determine if they are weighted or not; try first to decide by the feel, then make the burning test. Results?

(8) The silk you would use in knitting a scarf represents what kind of dyeing? If you dyed some silk stockings, what kind of dyeing is represented?

(9) What are the factors which make for high price in a silk knit article?

(10) What are the factors which allow some silk articles to be low-priced?

CHAPTER IV

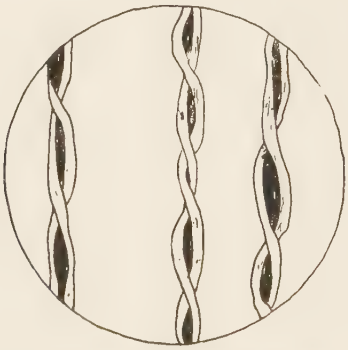
Cotton and Linen for Knitting

Importance of Cotton.—Although wool was the first fiber used for knitting, and silk is the most valuable, cotton is important because it is used in the largest quantity. This large demand for cotton in knit goods is due partly to the fact that it is the lowest priced of all the fibers, partly to the fact that it can imitate silk and wool, partly to the fact that much of it is used with silk and wool, and partly to the desire of the consumer for underwear which can be boiled.

Kinds of Cotton.—The cotton fiber may be two and a half inches long. It should be at least half an inch long to be of practical use in spinning. The cotton with the longest fiber (staple) is considered to be the best.

(1) *Sea Island* cotton has the longest staple and therefore spins easiest and is considered to be the best kind of cotton. Its name comes from the fact that it is grown on the islands off the coast of the Southern States. The crop now is small on account of the ravages of the boll weevil; most of it comes now from the West Indies. Sea Island cotton has not only the longest staple but is also the brightest, whitest, and finest cotton. The price per pound of Sea Island cotton is at least four times that of ordinary cotton. There are low grades of Sea Island cotton which do not merit these superlatives. Sea Island cotton is sometimes used in making lisle thread for knitting.

(2) The staple of the best *Egyptian* cotton is but little shorter than that of Sea Island. As its name indicates, it comes from Egypt; it has a characteristic dark color because it is stained brown by Nile mud. A high grade of cotton from Egyptian seed is being raised in Arizona; it is not brown. Egyptian cotton is more commonly used for knitting than Sea Island as it is more abundant and less expensive. It is used in high-priced hosiery and knit underwear.



Cotton under the microscope looks like a flat twisted ribbon

The characteristic cream color of the original "balbriggan" was due to the use of Egyptian cotton. Balbriggan knit goods were considered particularly durable. Other cottons are now dyed to imitate balbriggan.

(3) Cotton from the Southern States makes up most of the world's cotton crop. It varies in length of staple but is shorter than the best Sea Island or Egyptian cotton. *Upland, Peeler,* and *Delta,* are considered good varieties for use in knitting hosiery and underwear.

(4) *Peruvian* cotton comes, of course, from Peru. It is strongly brown in color and harsh to the touch. It is the cotton which is used to imitate wool.

Producing Cotton.—Cotton is picked by hand. The seeds, which make up two-thirds of the weight of the cotton as picked, are removed by the cotton gin, leaving the cotton fiber to be packed in bales and sold. The selling price of American cotton depends on its quantity and quality. The chief factor is the length of staple, though the price is lowered by staining, and by the presence of dirt.

Manufacture.—On reaching the mill the cotton, which has been packed very tightly in the bales, is fluffed up and cleaned. It may be *dyed in the stock* at this time. It then goes to the *carding* machines; here revolving cylinders, closely covered with short projecting wires, make the cotton into a long, thin, soft, thread-like roll called roving which may be spun into yarn of the desired size. The carding and spinning machinery work as they do in the case of wool (though the "ring spinner" instead of the mule spinner is often used).

Spinning combines the short cotton fibers into a yarn which is strong enough to be handled by knitting machinery. Spinning gives length and strength. Knitters usually have their cotton yarn spun to order.

Bleaching.—Knit cotton goods are bleached after they are knit but before being made into garments. The bleaching is done with chloride of lime and acid, or with liquid chlorine. Bleaching not only makes the cloth whiter but also more absorbent—a valuable quality in cotton underwear. If carefully done, the strength of the fabric is not materially decreased. Knit under-

wear manufacturers have agreed to use the word "Zepherized" to indicate a light weight bleached knit fabric.

Combed Cotton.—This phrase is a sign of quality cotton. It means that the cotton after carding has been passed through a machine which lays the fibers parallel, just as a comb arranges the hair. It eliminates short fibers. Combing machines demand long staple cotton —Sea Island, Egyptian, or the best American cotton. Combed cotton gives a smooth lustrous yarn which can be spun very fine. It is usually made into a ply yarn for greater strength.

Mercerization.—This process is an English invention in which cotton yarn under tension is soaked in lye; as a result, the fiber thickens and the cotton becomes *stronger* and much more *lustrous.* It is also able to take and hold dye better than untreated cotton. Mercerization is usually applied only to combed cotton and ply yarns.

Singeing or Gassing.—Because the cotton fiber is short, many short ends project from a cotton yarn; making it appear dull and fuzzy; such a yarn makes a fabric which is not "clear." If a yarn is passed rapidly through a flame the projecting fiber ends are burned off and the appearance of the yarn is improved. Combed cotton yarn which has been mercerized and singed has a silky appearance.

Lisle Thread.—This is a combed cotton ply yarn, tightly twisted, and gassed. It may or may not be mercerized. *Mercerized lisle* is sometimes called silk lisle on account of its appearance, but the phrase should not be used, as it creates a wrong impression. Lisle thread

is so smooth and strong that it is used to reinforce silk hosiery and to serve as a substitute for silk in the tops and feet of stockings.

Lisle thread will drop stitch much more easily than a soft fuzzy cotton yarn. Lisle thread garments are not as soft and comfortable as ordinary cotton.

Qualities of the Cotton Fiber.—(1) Cotton has a short fiber—from ¾ inch to 2½ inches. Because the fiber is short, the yarn requires more twists to the inch than yarns made from other fibers.

(2) The cotton fiber is like a twisted ribbon. The twist helps spinning. Mercerizing removes some of the twists thus increasing the luster. The twisted ribbon appearance of cotton shows plainly under the microscope and is a means of identification.

(3) Cotton is the dullest fiber.

(4) Cotton breaks easily but is stronger than wool.

(5) Cotton does not usually take dye as well as silk and wool.

(6) Cotton absorbs moisture, particularly if it is well bleached. This is a desirable feature in underwear.

(7) Cotton is not as elastic as silk or wool. It "matts" under pressure. Tight spinning as in lisle thread increases the elasticity.

(8) Cotton garments can be boiled (and sterilized) without weakening the fiber or causing it to turn yellow.

(9) Cotton, if fluffed up and made in heavy enough weight, has warmth; vice versa, if spun into fine yarn and knit in open mesh it makes a cool garment.

Summary.

Grades—
- Sea Island
- Egyptian—Pima
- American
- Peruvian

Harvesting and preparation—
- hand picking
- ginning (removes seeds)

Manufacturing—

Lower grades	Best grades
carding	
spinning	combing
bleaching	spinning
	ply-yarns
	bleaching
	gassing
	mercerizing

Qualities of the cotton fiber—short, like twisted ribbon, dull, not strong, absorbent, not elastic.

Technical Terms:

balbriggan (bal)	gassing	Sea Island
bleaching	ginning	singeing
carding	lisle	spinning
combing	mercerizing	staple
Egyptian	Peruvian	stock-dyed

Review and Merchandise Applications.—(1) Take each of the technical terms listed at the end of the summary—define it and show its relation to cotton knitting yarn or cotton knit fabrics. Watch for the use of these terms in labels and advertisements.

(2) What is the per cent of cotton in relation to the whole world production of textile fibers?

(3) Some people, even in the Northern States, wear knit cotton underwear the year around. Why do they choose it instead of wool in winter? Why do they choose cotton instead of silk?

(4) See if you can find a label on a pair of lisle top silk stockings which says Sea Island cotton. Watch for a knit goods advertisement which speaks of Sea Island cotton.

(5) Can you find the phrase Egyptian cotton on a knit goods label or in a knit goods advertisement?

(6) Examine a balbriggan garment. What are its characteristics? How does its price compare with a similar garment of ordinary cotton?

(7) Clip the current cotton quotations from a newspaper. Compare the price with that of silk and of wool.

(8) Ravel out a thread of the lisle top of a pair of silk stockings. How many ply? Ravel out a yarn from cheap cotton underwear or hosiery and compare with the lisle thread. Result?

(9) The effect of combing can be illustrated by combing a piece of cotton bat as you would your hair. Arrange the combed cotton in the form of a long thin roll. Twist between the fingers and compare the result with the other piece of twisted cotton.

(10) Examine the label on a ball of darning cotton. What does it tell of the quality of the material?

(11) See if you can find a label on cotton knit goods or an advertisement using either or both of the terms —combed, ply.

(12) You can illustrate the effect of spinning by taking a small piece of cotton, like absorbent cotton or a piece of cotton bat, pulling it out and arranging it in the form of a thin pencil-like roll. Twist one end of the roll between the fingers until you get a strong yarn. What two values has spinning?

(13) If you were looking for the best knit underwear, what grade of cotton would you expect? Why? What extra process would you expect to precede spinning? Why? What ply yarn would you expect? What finishing process would you expect? Why?

(14) Why does cotton require tight spinning? Why does it spin easily? Why does mercerization increase the luster? Why is lisle thread strong? Why does it drop stitch easily?

(15) Compare the appearance of cotton hosiery labeled "mercerized" with that which is not so labeled. Result?

Linen.—Linen is made from the flax plant; it is a fine fiber, longer than wool. It makes a particularly soft and absorbent knit fabric for underwear. Linen makes a cool fabric; like cotton it can be boiled without weakening or turning yellow. It is usually knit into a "mesh" fabric particularly open in texture so as to increase its ability to absorb moisture and ventilate the skin. It is quite high priced.

Find a linen mesh undergarment. How does its price compare with a similar silk garment? With a high grade cotton garment? Would you recommend a linen mesh garment? Why?

CHAPTER V

Rayon for Knitting

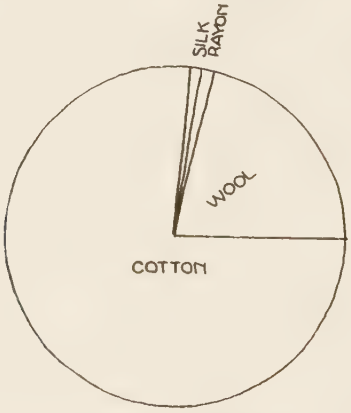
Introduction.—Rayon is the name adopted in 1924 for what used to be called artificial silk, fiber silk, or art silk. Those who make rayon, as well as those who use it and those who sell it, have agreed to discontinue the use of the old terms. Rayon is a manufactured fiber. The first method of manufacture was invented by a Frenchman, Chardonnet. He perfected his product and exhibited it at the Paris Exposition in 1900.

Importance.—Rayon used to be discussed in textile books at the end of a chapter on silk. Now, so much of it is made and used that it is accorded independent space. In the United States statistics show that 1,000,000 lb. were made in 1912, 15,000,000 lb. in 1921, 33,000,000 lb. in 1923, and about 50,000,000 lb. in 1925. A production of 70,000,000 to 80,000,000 lb. is predicted for 1926. The knitting industry is the largest user of rayon. The price of rayon per pound is less than half as much as that of raw silk.

Preparation.—Rayon today is made either from wood pulp or cotton linters. The essential component of both these is *cellulose* (as of all plant tissue); therefore rayon is a cellulose product. In trying to copy the product of the silk worm, Chardonnet experimented with mulberry leaves and mulberry wood, trying to change them as the silk worm did into a silky fiber. He

ended by using cotton as a basis for making a fiber which looked like silk.

The manufacture of rayon is a chemical process, no matter whether the Chardonnet method or some of the more recently invented processes is followed. The chemical treatment serves to convert cellulose (wood pulp or cotton linters) into a soluble material, a liquid of the appearance and consistency of glue. The liquid



World production (1923) of chief fibers used in knitting

	Pounds	Per Cent
Cotton	9,000,000,000	76.36
Wool	2,600,000,000	22.06
Rayon	97,000,000	.82
Silk	87,000,000	.74

(Viscose Co.)

is forced out of a nozzle provided with many fine holes; the streams thus produced dry and harden, forming shiny fibers of rayon which are collected and twisted together to make a rayon yarn. A twist of 2½ to 5 turns to the inch is usual.

Value of Rayon.—The demand by manufacturers for rayon is indicated by the figures given in paragraph 2 to show the rapid growth of the industry in the United States. Rayon has the appearance of silk at less than half the price of raw silk (one-fifth the price of thread silk). Because of its low price it can be made into a heavy fabric without the addition of "weighting." The use of the new name, rayon, will help it to stand on its own merits so that it will no longer be considered an imitation of silk. Tests of its durability by interested manufacturers have shown that it can compete with either silk or cotton on that score. Its smooth surface sheds dirt but absorbs moisture. White rayon never turns yellow. It dyes well, taking the high colors demanded for sport wear.

Rayon is now being made into much finer yarn than formerly. A 45 denier yarn is available now—that is, one only three times as heavy as 13/15 denier raw silk.

In considering the value of rayon it must be remembered that there are different grades of rayon just as there are different grades of silk and wool and cotton. Undesirable qualities of rayon tend to disappear when it is made into knit fabrics—even its high luster is dimmed.

Qualities of Rayon.—(1) Rayon is the smoothest and most lustrous of the fibers.

(2) It dyes readily.

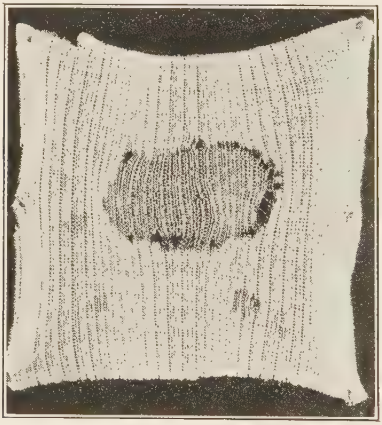
(3) It is strong except when it is wet, when it loses a large proportion of the strength. It regains its strength on drying.

(4) White rayon fabrics do not turn yellow.

Tests.—Since rayon is made from cellulose, its action in tests is like that of the other vegetable fibers—cotton

and linen. The tests which were given as a means of distinguishing cotton from wool (an animal fiber) will serve to distinguish rayon from silk (the other animal fiber).

(1) Rayon burns as cotton does, only more rapidly; it leaves but little residue (except in the case of Celanese, which forms a knob); the smoke smells like



Flat iron test applied to a silk and rayon mixture. The rayon is eaten away and the small proportion of silk shows in the thin place in the center

burning paper. Silk forms a knob and its smoke smells like burning feathers.

(2) Rayon is not affected by boiling with 5 per cent lye for five minutes; silk disappears (except wild silk, which takes longer boiling).

(3) Rayon is charred by 2 per cent sulphuric acid and heat in the flat iron test; silk is not affected.

(4) The microscope shows that the rayon fiber is thicker than the silk fiber.

(5) Rayon weakens when wet. The test is usually made by thoroughly moistening the sample in the mouth and then trying to break it.

Summary.

Manufacture: Cotton or wood plus chemicals gives a thick liquid. The thick liquid, forced out of many fine holes, forms fibers which are twisted together.

Advantages: Low price (compared with silk); high luster; takes and holds dye; strong; has weight without weighting.

Disadvantages: Weakens when wet; thick stiff yarns.

Tests: Acts like cotton and linen in the burning test, flat iron test, lye test; weakened by water.

Review and Merchandise Applications.—(1) What is the meaning of cellulose as used in connection with rayon?

(2) Which of the textile fibers are natural? Which artificial? Which are animal and which vegetable?

(3) Tell two methods of distinguishing rayon from mercerized cotton.

(4) What is the difference between rayon and artificial silk?

(5) If a knit vest of rayon and one of silk were given equal care, which would give longer wear? How do they compare in price? What advantages has the silk vest?

(6) What good points has a petticoat or slip of knit rayon?

(7) Can you tell whether a necktie is knit of rayon or silk? What advantages in a necktie of rayon?

(8) Can you find labels or advertisements using the terms, Rayon, Tubize, Celanese, or Viscose?

(9) Is it your experience that the use of the old terms, fiber silk, artificial silk, art silk, have been discontinued?

(10) A little idea of how the rayon process works can be gained by using a tube of liquid glue. Squeeze a drop out of the tiny hole so slowly that as it falls it dries into a fine thread.

(11) Apply the burning test and the breaking test to known samples of rayon and of silk.

(12) Apply the chemical tests to samples of "plated silk" from discarded underwear and hosiery.

(13) What is the price of rayon per pound now?

CHAPTER VI

Fiber Combinations for Knitting

Methods of Combining Fibers.—Any one of the textile fibers may be combined with any of the others. There are two different methods of combination commonly used:

(1) Two or more different kinds of fibers can be mixed or blended before spinning in order to secure certain qualities.

(2) Two entirely different yarns can be used together in a fabric in three different ways:

(a) They can be used side by side, holding them in the knitting process in such a way that one is always thrown to the surface. This is called plating. The effect corresponds to that in plated silver. The reason is the same also—a good appearance with lower cost and increased strength.

(b) Two or more different yarns can be twisted together.

(c) Alternation of two yarns in different rows during knitting for decorative effect.

Cotton Combinations.—(1) Cotton with wool.

Cotton is used with wool in knit fabrics for four reasons:

(a) Cheapness—cotton costs about one-quarter as much as scoured wool. As the percentage of wool in a mixture increases, the price increases.

(b) Strength—it is used to reinforce low-grade wool and parts of hosiery which get the most wear.

(c) Decrease or prevent shrinkage.

(d) Comfort—so that the garment will not be too warm.

The common methods of combining cotton and wool are:

(a) Cotton is blended with wool, making a "wool mixture." Usually the cotton is present in the larger proportion.

(b) Wool plating on cotton is often used in hosiery and underwear. Any one of the reasons given above for combining cotton and wool may apply. Wool plating, because of the use of the two yarns, gives a stronger fabric than "wool mixed." In a wool plated rib knit fabric the wool will be found on both the inner and outer surfaces, the cotton lying hidden between the ribs.

(c) A row of yarn which is part wool, all wool, or all cotton, may be knit in after one or more rows of an all-cotton or a wool mixed yarn.

(2) Cotton with silk.

Cotton is used with a silk plating. This decreases the cost and increases the weight and the durability. Sometimes the body of the garment is plated.

(3) Cotton with rayon.

Cotton is used with a rayon plating. Cotton helps rayon by decreasing its stiffness, dulling its luster, increasing its strength when wet, decreasing its tendency to drop stitch, and allowing the use of a finer thread.

Wool Combinations.—(1) Wool with rayon.

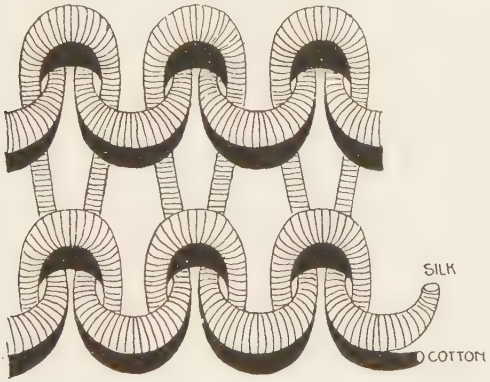
Since rayon is made of cellulose, while wool is an animal fiber, they react differently to dyes. The

dyes which will color one, will not affect the other, and vice versa. Consequently rayon and wool combinations can give interesting color effects. Many "silk and wool" knit items are really rayon and wool.

(2) Wool with silk.

Silk is put with wool to decrease shrinkage in undergarments, to make a thinner fabric, and a more luxurious effect.

Silk Combinations.—The combination of silk with wool and cotton have been discussed. When silk is combined with rayon the pleating method is used.



Silk plating on cotton. Most of the cotton is thrown to the back

Rayon, as has been said, is cheaper than silk, and gives body to the fabric. It gives weight without weighting. This combination is much used in underwear fabrics. It is satisfactory on the score of appearance, durability and price.

Summary. — Possible combinations: Cotton with wool, silk or rayon; silk with cotton, wool or rayon; wool with cotton, silk or rayon; rayon with cotton, wool or silk.

Methods:

blending of fibers
plating of yarns
twisting of yarns
alternation of yarns

Purpose:

vary the qualities
improve the appearance
decrease the cost.

Review and Merchandise Applications.—(1) What chemical affects silk? Which of the fibers is similarly affected?

(2) What chemical dissolves wool? Which of the fibers is similarly affected?

(3) Name the six possible combinations.

(4) Which fiber is used for strength? For cheapness?

(5) What advantage has silk and wool over rayon and wool?

(6) Which method of combining makes for increased strength?

(7) How only are silk and cotton combined?

(8) Why is wool added to cotton?

(9) Find a pair of rayon and cotton socks or stockings. How can you tell that there is rayon and cotton? Which of the advantages named do you know to be true? Compare the price with that of a similar cotton stocking; a similar all-rayon stocking.

HOW TO ILLUSTRATE WOOL PLATING ON COTTON

(10) To illustrate wool plating on cotton examine the heel of a discarded sock which seems to show cotton on the back. Unravel and untwist a yarn. How many distinct yarns are there? Test each individual yarn by the burning test. Is there any cotton? What proportion? Try the flat iron test on a piece of the heel. Result? What proportion is wool? Examine a worn place—which thread is left? What value had the cotton in the heel of this sock (see paragraph 2, section 1).

(11) To emphasize the percentage of wool in cotton —wool knit goods, use a piece of discarded wool underwear, or the upper part of a sock or stocking sold as wool mixed. What can you tell about the composition by examining the piece? By raveling a thread? Try the lye test on one piece of the fabric. Result? Try the flat iron test on another piece. Result? What is the percent of wool in the garment under examination? What value has a very low percent (say 3 per cent) of wool?

(12) To illustrate the use of varying threads in varying rounds, find a discarded part wool (or silk and wool) baby's vest. What can you tell by examination? By unraveling? By the flat iron test? What is the proportion of wool? What value has it?

(13) The blending of wool and rayon is often found in a yarn used for sweaters and hosiery. Give two reasons. It is often wrongly called silk and wool. Try to find a discarded stocking showing this combination. Unravel and untwist a yarn. Is it woolen or worsted? How do you know? What color is the wool? The

rayon? Is the rayon fiber short (low grade) or long? What do you think about the grade of the wool?

(14) If silk is blended with wool, spun silk is used instead of thread silk. Give two reasons why. How can you tell by the appearance that spun silk is used?

(15) Sometimes silk yarns and wool yarns are twisted together. Give three reasons.

(16) Compare the price of a pair of silk plated socks or stockings with the price of "pure silk." The heel of a silk stocking is usually plated. Why? Examine the right and wrong side of the heel of a silk stocking. In what two ways does plating show? Can you find a thin place—which thread is gone?

(17) Unravel a piece of a discarded vest which you think contains rayon and silk. Untwist the yarn. How many different components are there? Test them by the burning test. Result? Test a piece of the fabric by the flat iron test. Which fiber is left? Test another piece by the lye test. Which fiber is left? What is the proportion of rayon and silk?

CHAPTER VII

The Fundamentals of Knitting

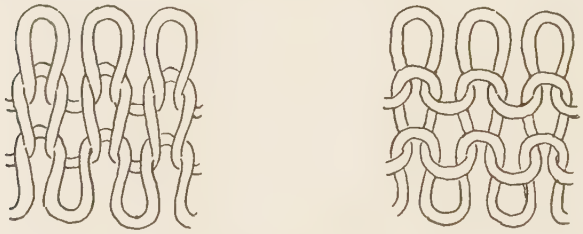
Introduction.—Quite early in the history of civilization, fabrics were made by felting wool and plaiting grasses. Then spinning developed and cloth was woven on looms using yarns spun from the linen fiber of the flax plant, from wool and from silk. In the fifteenth century, hand knitting added another method of making yarn into a fabric.

Lee's Machine.—The hand knitter can work in two different ways. Either four knitting needles can be used and the work goes round and round, making a tube, or only two needles can be used and the work goes back and forth, forming a flat piece. Lee first attempted to make a stocking as he had seen the hand knitter make it—tubular fashion. Unsuccessful in this, he tried the other, and after at least three years of effort, perfected his "stocking frame" in 1589. The flat piece which his machine knit and shaped was formed into a stocking by sewing the edges together.

Lee could not get a patent for his machine in England so he negotiated with the French court and finally took his machines and his workmen to France. Soon after his arrival, the French king died, religious persecution followed, and Lee fled from Paris and died in poverty. His men returned to England with the machines; this time interest was developed, and the new industry began to grow.

The first machines could knit twice as many loops per minute as the hand worker. These machines were very complicated and required the use of the feet as well as the hands.

Kinds of Knitting.—Today there are two entirely different kinds of knitting. In *weft knitting* a continuous yarn goes crosswise of the fabric as weft yarns are used in weaving. "Weft knitting" is what we ordinarily think of as knitting and is so common that



Jersey (or flat) knitting. Left, right side; right, wrong side

the term is usually shortened to "knitting." *Warp knitting* will be described in a separate chapter.

Machines for Weft Knitting.—There are two kinds of machines for weft knitting:

(1) A flat machine which produces a flat fabric.

(2) A circular machine which produces a tubular fabric.

Flat Knitting.—In the flat knitting machine, the yarn moves from one side of the frame to the other. This was the first type of machine, and for almost 250 years after Lee's death was the only kind of knitting machine available.

Flat knitting machines are used today in making full-fashioned underwear and hosiery. Flat knitting machines are used in making the elaborate knit patterns.

N. B.—A flat knitting machine can produce a tubular fabric. In order to do this a machine requires two sets of needles, and having knit across one row of needles it knits back on the other. The process can be compared to the weaving which produces a tubular pillow case.

Circular Knitting.—A circular machine, which would knit a tube-like fabric, was patented in England in 1816; it was not adopted by the industry until it had been improved by a Belgian inventor, who in 1845 exhibited it to the knitters of England and satisfactorily demonstrated its value.

Even then its progress was slow. This was due partly "to an intuitive dislike to the idea of making stockings in the form of bags," and partly to the feeling that the circular machine would "inevitably reduce the wages of the workers."

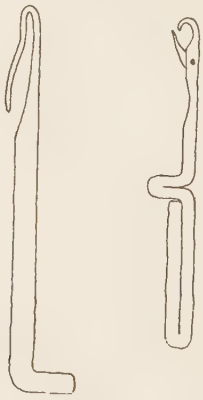
A circular machine is sold for home knitting. Even the large machines used in factories are more simple and compact than the flat frame. The circular machine works more rapidly than the flat frame, thus making the finished product cost less.

The circular machine is used in knitting "seamless" stockings, underwear fabric, wool jersey, tricolette, neckties, mufflers, and mittens.

N. B.—The circular machine can produce a flat material instead of tubular by knitting part way round the circle of needles, then back.

Kinds of Knitting Needles.—The needles used on a knitting machine are not at all like the needles of the hand worker; they are hooks. The machine holds as many of them, laid side by side, as there are loops in the knitted fabric. There are, today, two kinds of needles available for machine knitting. One is the spring beard needle invented by Lee, the other is the latch needle, which was not invented until 1854.

The Spring Beard Needle.—The diagram shows the shape of the spring beard needle. As in hand knitting, large sizes are used for coarse work, small sizes for



Left, spring needle; right, latch needle

fine work. The loop is formed on the hook, then pushed away from it, then the beard is pressed down into a groove in the stem of the needle, thus making a smooth surface for the loop to slip over. Spring needles are used for the finest knitting.

The Latch Needle.—The diagram shows the shape of the latch needle. A loop is formed in the hook, is

pushed back, thus opening the latch; as the loop passes off the needle, it closes the latch, thus eliminating the necessity for a presser bar (which the spring needle requires). Because the latch needle closes automatically it can work faster than the spring needle.

The United States has made many of the improvements which have facilitated the use of the latch needle and increased the speed of the circular machine.

A latch needle mounted on a handle is used in repairing "runs" in knit fabrics.

Kinds of Weft Knitting.—As has been stated, weft knitting can be made on a machine which will produce a flat fabric, or it can be made on a circular machine which will produce a tube-like fabric. Both the flat and the tubular fabric can be made either with a smooth surface called *flat goods,* or with a surface which is *ribbed.*

Flat Goods.—This term is used to describe a knit fabric with a smooth surface. It shows vertical rows of loops (wales) on the face, and crosswise lines (courses) on the back. It may be knit either as a flat piece or as a tube.

Flat goods are used in stockings, wool jersey, tricolette and balbriggan. It will drop stitch either up or down.

Rib Knitting.—The hand knitter made the first rib knitting. It was not until Strutt, an Englishman, invented in 1758 an attachment to Lee's machine, that a machine could knit a ribbed fabric. Until that time, if a machine-knit stocking must be ribbed, drop stitches were made in the finished article and then these stitches were reknit on the wrong side, by hand!

Strutt's invention, whether applied to the circular or the flat machine, uses two sets of needles; one in front of the other. One set makes the face rib, the other the

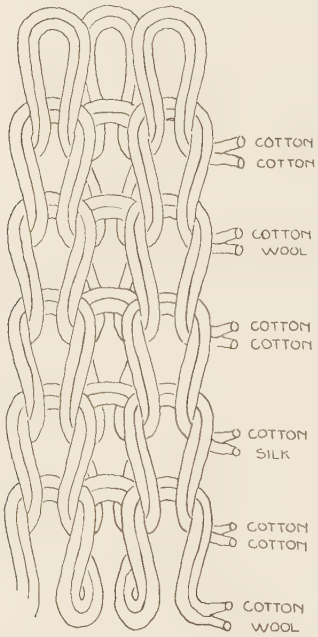


Illustration of rib knitting showing construction. This is also an illustration of ply yarn

back rib. This invention is next in importance to Lee's in the knitting industry.

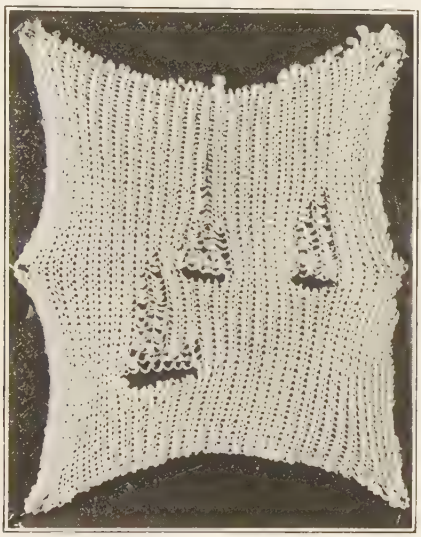
Characteristics of Rib-Knit Fabrics.—(1) They have an accordeon-like appearance.

(2) They are more elastic than flat knit fabrics; they stretch nearly twice as much. Rib knitting is used where a close fit is required.

(3) They are thicker than flat knit fabrics, and, therefore, warmer.

(4) They do not drop stitch as readily as flat knit fabrics.

(5) They are particularly durable, due to the elas-



Rib knitting of the "one and one" type drop stitches in only one direction

ticity and thicknesses of the fabric, and to the fact that they do not drop stitch as readily as flat knit fabrics.

(6) Rib knitting is a slower process than flat knitting, making it higher priced.

Gauge.—If a fine knit fabric is required, it is necessary not only to use a fine yarn but also to use fine needles and to set them close together in the machine.

Lee worked out this detail in his vain endeavor to gain Queen Elizabeth's interest (and a patent). The first machine-made stockings were knit of worsted yarn. In order to knit a pair of silk stockings for the Queen, Lee made a new machine, using smaller needles placed more closely together.

Gauge is the measure of the fineness of the knitting. A fine stocking is 42 gauge, which means that there were 28 needles (2 3 of 42) to an inch in the machine. A coarser fabric is represented by a lower gauge number.

Comparing two fabrics knit of the same yarn, the one which is high gauge drop stitches less easily. The higher the gauge, the less tendency to drop stitch.

Summary.—(1) Mechanical Processes.

Kinds of knitting, warp (many yarns); weft (one yarn).

Kinds of weft knitting machines, flat, circular.

Kinds of needles, spring beard, latch.

Kinds of weft knit fabric, flat goods, ribbed.

(2) Technical terms used:

balbriggan
circular knitting
circular machine
course
drop stitch
felting
flat goods
flat machine
full-fashioned hosiery
full-fashioned underwear
gauge
jersey
latch needle
plaiting
ribbing machine
ribbed knitting
seamless stockings
spinning
spring bead needle
tricolette
tubular knitting (on flat machines)
wales
warp knitting
weft knitting

Review and Merchandise Applications.—(1) How does a knitting machine compare with a loom in complexity of mechanism?

(2) Which of the two types of weft knitting machines did Lee invent?

(3) Which of the two types of needle did Lee invent?

(4) What is the opposite term to warp knitting?

(5) What is the trade term for ordinary knitting?

(6) What kind of machine knitting requires two sets of needles?

(7) What kind of knitting is made with a selvedge?

(8) What knit yard goods are knit tubular?

(9) How do full-fashioned stockings show that they were knit as a flat piece?

(10) Find an advertisement of spring needle knit goods. What value is claimed for the spring needle?

(11) Examine a silk stocking. How can you tell the right side? The up and down? What term is used to describe this kind of knit textures?

(12) Make a *small* hole in a piece of an old stocking. Prove that it will drop stitch up and down.

(13) Does wool jersey drop stitch easily? Why? Tricolette? Why?

(14) Examine a piece of an old rib knit union suit. How many loops in each rib? In which direction do the ribs run in the garment? Make a small hole in the material. Make it drop stitch. Result?

(15) What advantages in making men's underwear completely or in part of rib knit instead of woven fabric?

(16) Find two knit garments the same in style and make, except that one is flat knit, one rib knit. How do

they compare in price? Explain. What advantage in the flat knit garment?

(17) Determine by careful measurements how far one inch of the ribbing at the top of a sock will stretch; repeat for the flat knit body of the sock. Result? Conclusion?

(18) Name three entirely different uses of rib knitting in which it serves to give a close fit.

(19) How does a ribbing machine differ from one making flat goods?

(20) Examine balbriggan as used in ladies' dresses. What yarn is used? What technical name for the texture?

(21) How does balbriggan differ from wool jersey?

(22) Compare the cheapest and the most expensive silk stockings as to gage. Result?

(23) Explain the meaning of each of the technical terms given in the summary.

(24) Give eight advantages of rib knitting over flat goods. Why are ladies' stockings made of flat goods?

(25) What advantage has the circular machine? The latch needle?

(26) Examine tricolette. What yarn is used? What advantages has this material? What disadvantages?

CHAPTER VIII

Other Knitting Processes

Strengthening Weft Knit Fabrics.—The methods already given for strengthening each of the different kinds of yarns used in knitting can be summarized under two general heads:

(1) Giving more twists to the inch as in the silk used for chiffon hosiery.

(2) Twisting two or more strands together as in a lisle thread, a ply worsted yarn, or the 12-strand silk used in "heavy duty" stockings. Sometimes two yarns of different strength are twisted together, as when cotton is twisted with wool.

The fabric can be reinforced during the knitting process either by substituting a thicker or stronger yarn, as when lisle thread is used for the tops and soles of silk stockings, or by using two or more strands of yarn instead of one, thus producing a heavier fabric (splicing). In this last case:

(1) The strands may be alike, as in the reinforcement of underwear and children's stockings.

(2) A cotton yarn may be used to back silk, wool, or rayon. This is known as "plating."

Plating.—The term "plated" as used in knitting has the same meaning as when used in the phrase "gold plated" or "silver plated." It means that a more expensive yarn is used on the outside of the fabric, and that a

less expensive and stronger yarn is used on the inside. An illustration is found in the plating of rayon on cotton hosiery. The cotton is like a lining and does not show on the right side. The difference in the character and position of the two yarns used in plating shows distinctly when the silk in the heel of the stock is plated on lisle.

In rib knit fabrics, the lower priced yarns are thrown between the ribs and do not show. A wool plated ribbed undergarment shows wool on both the front and back faces.

Making Fleece Lined Fabrics.—A fleece lined fabric may be considered as a plated fabric. The yarn which makes the "fleece lining" is made of short fibers of cotton or wool. It is thick and loosely spun. Besides this yarn and the face yarn, a third yarn is required to hold the two together. The fabric is finished by napping the lining to give a fluffy surface. Eiderdown is an illustration. The warmth of fleece lined fabric is due to the air held in the projecting fibers and between the two layers of knit fabric.

Cheap fleece lined fabrics are knit with only one yarn. Many people think that because a fleece lined garment is woolly it is made of wool; often it is all cotton.

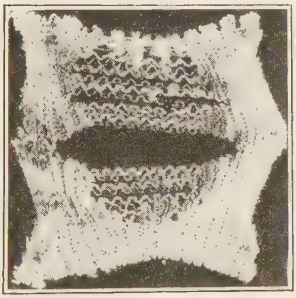
Joining Flat Knitting and Rib Knitting.—A combination of flat knitting and rib knitting is used in many garments. Rib knitting, with many more stitches to the inch, is used on the top of flat knit stockings because of the extra elasticity of the rib knitting. Rib knit cuffs are used on sweaters because they fit more closely than the fabric used in the body of the sweater.

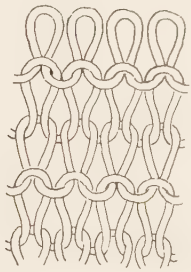
Pieces of ribbed fabric are knit separately and later joined to the rest of the garment in one of two ways:

(1) The piece of ribbing may be sewed on the flat knitting. This is the cheapest method. The seam which joins the two pieces tends to limit the elasticity of the ribbed fabric.

(2) The piece of ribbing may be transferred loop by loop to the flat knitting machine—a slower, more expensive process.

Purl Knitting, Cardigan Stitch, and Rack Knitting. —These are three of the methods used in changing the stitch and, consequently, the appearance of knit materials. They are used alone or in connection with





Left—After flatiron test. Heavy yarns are spun silk, fine yarns are wool. Right—Purl knitting has a crosswise rib. It is the same on both sides

either flat or rib knitting—for example, on golf stockings, sweaters and mufflers.

Purl knitting, which is simplest, gives a crosswise rib, alike on both sides (also called link and link).

Rack knitting shows a characteristic twill pattern. It is used for decorative borders on sweaters and some-

times for the firm strip placed on both sides of the shoulder seam. Many neckties are knit in rack stitch.

The complex Cardigan stitch is used to give a vertical rib effect, making a thicker, warmer fabric than ordinary ribbing. Cardigan rib is often used with plain rib, for instance, in a sweater sleeve where the cuff would be plain rib. The Cardigan rib knits up wider than plain rib, thus shaping the sleeve.

Knitting With the Jacquard Attachment.—This French invention is a means of producing fancy patterns by automatic change of color and stitch. The design is worked out on cross section paper. Each loop is represented by a square, each two rows of knitting by a row of squares. Strips of cardboard, one for each row of knitting, are punched with small circular holes. The holes control the action (or inaction) of the needles as the roll in a player piano controls the action of the piano keys. The strips are fastened together in an endless chain. At the end of a revolution of the chain, the design is repeated. The Jacquard can control the formation of lace patterns, various stitch combinations, and color.

Shaping a Knit Fabric.—Three of the methods commonly used are:

(a) When a fabric is knit as a flat piece, it can be narrowed by knitting two loops together or widened by adding loops. This method of narrowing shows near the seam in the back of a full-fashioned stocking. The number of stitches at the ankle is less than at the top of the leg.

(b) The tubular fabric is narrowed by increasing the tension on the yarn, thus tightening the stitch. This method is used in shaping a "fashioned" stocking.

The number of stitches at the ankle is the same as at the top of the leg, but they are closer, making a thicker, firmer fabric.

(c) Many garments are made of knit fabric which has been cut to shape.

Increasing the Speed.—Lee's machine could work ten times as fast as the hand knitter. Improvements soon increased this speed to fifteen times the rate of the hand knitter. Still more speed came in 1769, when the crank drive was adapted to the knitting machine. After that the machine could work no faster until the circular machine and latch needle were used, about 1850. Then power could be applied.

The use of multiple yarns on the circular machine allows the knitting to proceed so rapidly as to far outdistance weaving in speed of production. Chamberlain and Quilters' book, "Knitted Fabrics," which was published in England in 1920, makes the statement that a circular rib-knitting machine having 24 yarn feeders can make 1,500,000 stitches in a minute, producing in that time 15 inches of fine underwear fabric 64 inches wide. This is, of course, much more cloth than any loom can weave in the same time. The book also states that there are circular machines knitting a plain fabric which have 80 to 100 yarn feeders and produce correspondingly more yardage, though of a lower grade. These figures emphasize the point that knit fabrics are cheaper than woven fabrics because they can be made more quickly. Automatic control has still further increased the speed of machine knitting.

Introducing Color.—(1) Color crosswise stripes are easily produced in weft knit fabrics by arranging the various colored feed yarns in the required order.

(2) Suppose that several needles were thrown out of action by the use of the Jacquard, then the yarn for these needles would appear on the back of the knit fabric. At the next row these needles could knit with another color. By repetition, this process would give a knit fabric with vertical stripes or other design on the face and unused yarn showing across the back.

(3) Suppose that by means of the Jacquard certain needles could be reversed in their action—that is, the back textures would appear on the face. Suppose that under these conditions a two-colored plating yarn was used. Then one color would be on the surface with the looped face and the other color would be on the surface where the horizontal courses showed.

Summary.—(1) Mechanical Processes:

Strengthening
- (1) yarn
  - more twists to the inch
  - many yarns used as one, twisted-ply
  - many yarns used as one, untwisted
  - use of thicker or stronger yarn
- (2) fabric
  - splicing
  - plating

fleece lining

joining flat and rib knitting
- (1) sewing
- (2) transferring

fancy stitches
- (1) purl cardigan
- (2) tuck open work
- (3) rack

Jacquard
- (1) color
- (2) stitch

fashioning
(1) adding or subtracting loops (full fashioned)
(2) decreasing size of loops (increase gage)
(3) cut fabric

increasing speed
(1) circular machine
(2) latch needle
(3) power
(4) automatic control
(5) multiple feed

Technical terms used:

cardigan stitch	lisle	purl knitting
fashioning	multiple feed	rack stitch
fleece-lined fabrics	plating	splicing
Jacquard	ply	12-strand silk
link and link		

Review and Merchandise Applications.—(1) Find some underwear which has been reinforced during the knitting process. Explain the method.

(2) Find a ribbed wool garment which is plated. Explain the process.

(3) Find a stocking with a high spliced heel. Explain how it was made.

(4) Find a plated silk vest. What is the inferior yarn? How does the plating show? Value?

(5) Find a piece of ribbing which has been sewn to the main body of the garment. Stretch, to see if there is any binding at the seam.

(6) Find a garment in which the ribbing has been joined by transferring stitches. Has the number of stitches been changed? Why?

(7) Find a knit article which shows purl knitting. Does purl knitting stretch most—up and down or crosswise?

(8) Find a sweater with ribbed sleeves as well as cuffs. Do you think cardigan stitch was used in the body of the sleeve? Explain.

(9) State four advantages in the use of cardigan stitch in a wool outer garment.

(10) Find a sweater showing rack knitting. How do you know it? Where is it used? What is its value? Is it made in a separate piece and sewn on, or knit with the garment?

(11) Find a full-fashioned knit undergarment. How was it shaped in knitting? How does its price compare with that of similar garments not full-fashioned?

(12) Find a stocking which shows smaller stitches near ankle. What name is given to this kind of stocking? How does its price compare with that of a similar full-fashioned stocking? Compare the gage at the top of the stocking with that at the ankle.

(13) Find a garment which shows that different yarns were used in different rows. Trade name for the fabric.

(14) Find some sport hosiery showing a fancy design in color and stitch. How was the pattern regulated? What is the relation of the colors on the right and wrong side?

(15) Can you find a sweater which has been shaped by cutting? How can you tell?

(16) Can you find an advertisement using any of these terms—purl, Jacquard, rack stitch, cardigan, link and link?

(17) In which direction does a purl knit fabric stretch most?

CHAPTER IX

Warp Knit Fabrics

Introduction.—Warp knitting was invented about 1775. The name warp knitting was given because the yarns which were used were placed side by side like the warp (lengthwise) yarns in a loom. Warp knit fabrics are always flat fabrics.

Kinds of Warp Knit Fabric.—Warp knitting machines use silk, wool, cotton, linen, or rayon yarns. They can make a warm wool overcoat material, a lacy silk scarf, or a linen mesh fabric for underwear. They can fashion cotton into a lace doily for the table or a floor cloth for the kitchen. They can produce a smooth, leather-like surface or a variety of fancy stitches.

The best known warp knit fabric is "glove silk," knit of very fine silk yarns and in a close gage, thus making a firm, lightweight, durable material.

Glove silk may be either "tricot" or "Milanese." Tricot is the type commonly used for underwear, as it is less expensive; Milanese is the type used for gloves, as it is more durable. Milanese is easily distinguished by the diagonal lines which show distinctly when the material is held to the light.

"Tricot" and "Milanese" apply not only to silk warp knit fabrics, but also to warp knit fabrics made of other yarns.

Characteristics of Warp Knit Fabrics.—(1) They do not drop stitch readily.

(2) They are durable.

(3) They are not very elastic.

(4) They shrink in washing.

(5) They are reinforced by adding extra pieces.

Fabric Gloves.—These gloves are cut from warp-knit material, sewn together and decorated like kid gloves, for which they make a useful substitute. Some fabric gloves show distinct crosswise rows of loops on the back. This is called Atlas stitch and makes a heavy glove. A heavyweight glove is made out of *duplex cloth.* This may consist of either two pieces of warp knit fabric pasted together, or else of a material which requires two sets of warps, one to knit the face, the other to knit the back of the fabric. Interlooping holds the two materials together.

The *suede finish* sometimes given to cotton gloves is made by roughening the surface.

Fabric gloves slip on easily and wash easily. Fabric gloves follow closely the styles in kid gloves, but are lower priced.

Glove Silk Hosiery.—Stockings made out of Milanese fabric were used when heavy silk stockings were in style. They did not fit the ankle trimly because the material was not sufficiently elastic. Although they did not drop stitch like other silk stockings, they did not give satisfactory service; they wore out quickly at the heel because the reinforcing piece and the main fabric rubbed together. Glove silk stockings are little used now except when it is necessary to hide a skin defect.

Glove Silk Underwear.—This apparel is being sold in large quantities instead of the old type of "knit" underwear. The fabric does not drop stitch and the

Warp knit fabrics will dropstitch. Above—Milanese

Knitted lace. Part of a silk scarf warp knitting

garments are cut in "athletic" style which is in favor. The material is usually tricot, as Milanese is considered by most buyers to be too high priced. Glove silk under-

wear gives satisfactory service—if a good quality is selected.

Milanese fabric shrinks in washing in both length and width. Tricot shrinks somewhat in length.

Low-priced glove silk underwear is liable to be weighted with tin in order to make it seem heavier than it really is. Weighting decreases the durability. The test for weighting was given in the chapter on silk.

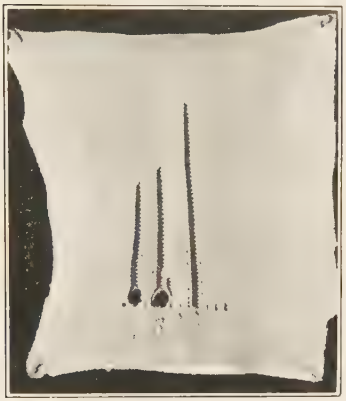
Warp knit fabrics of rayon are being made into underwear. The material is usually heavier than a warp knit silk fabric.

Glove Silk Lingerie.—Glove silk (Milanese or tricot) can be bought in the yard goods section of the larger stores and made up at home. It is made commercially into petticoats, night dresses, chemises and bloomers, substituting for crêpe de Chine and other woven silk materials.

Warp Knit Fabrics for Corsets and Brassières.—Either a cotton or a silk fabric is used for these garments. It is always made up with the up and down of the cloth going crosswise of the garment. The material, though firm, stretches enough to conform to the shape of the figure; the original shape will return as the garment shrinks in washing.

Warp Knit Fabrics for Outerwear.—A light weight warp knit wool material is being used for women's wear and children's clothes. The material tailors well, is low-priced and durable, but is not suitable for formal wear. Men's overcoats are made of a heavier fabric. Fulling and napping conceal the knit construction.

Warp Knit Open Work Novelties.—Rayon in high colors is used to fashion lace scarfs and handkerchiefs.



Tricot

A warp knit fabric has a looped construction so it is knit, not woven. The vertical warp yarns can be traced. Study of the figure will show that the crosswise as well as vertical interlacing of the yarns tends to decrease the chance of drop stitching

Lace doilies are made of fine cotton in warp knit construction.

Warp Knit Household Items.—Face cloths, towels and floor cloths are sometimes made of warp knit cotton.

Summary.—Qualities—Does not drop stitch easily; firm, not very elastic; shrinks, durable.

Uses—Gloves, hosiery, underwear, lingerie, corsets and brassières, outerwear, open work novelties, household items.

Technical terms used:

Atlas	napping
duplex	reinforcing
fulling	suède finish
gauge	tricot
glove silk	warp yarns (weaving)
Milanese	weighting

Historical Facts About Knitting.

Fabrics made by felting wool and braiding grass.

Development of spinning and weaving.

1461—(or earlier) hand knitting invented.

1589—Knitting machine invented by Rev. Wm. Lee.

1769—Crank drive.

1775—Warp knitting.

1816—Circular machine invented.

1845—Circular machine used.

1854—Latch needle.

1857—Power drive.

Review and Merchandise Applications.—(1) Examine a pair of silk gloves. Are they Milanese or tricot? Where are they reinforced? How?

(2) Can you find a pair of Milanese lisle gloves? Of Atlas fabric gloves?

(3) Can you find an old pair of duplex gloves? Which of the two methods of making duplex fabric was used?

(4) What objections to fabric gloves?

(5) Examine a pair of glove silk stockings. Price? Are they Milanese or tricot? Where are they reinforced? How?

(6) Find a Milanese silk undergarment. Price? Where is it reinforced? How?

(7) What is the range in price in glove silk vests? How do they account for it?

(8) Compare a glove silk vest with a silk weft-knit vest as to price, elasticity, reinforcement, shape, weight. Which would you choose? Why?

(9) How would you determine if a new glove silk vest was weighted?

(10) How does a glove silk garment compare in price with one of crêpe de Chine of similar weight? What advantage has glove silk over the woven fabric?

(11) Find some glove-silk yard goods. Price? Width? Uses? Is it Milanese or tricot?

(12) Can you find any rayon warp knit undergarments? How do you know they are rayon? How do you know they are warp knit?

(13) Examine a brassière made wholly or in part of knit material. How is the fabric knit?

(14) Find warp knit outergarments. Trade names? How do they show that they are knit?

(15) What dress accessories can you find which are warp knit?

(16) What household items, made by warp knitting, can you find?

(17) Explain the meaning of each of the technical terms listed in the summary.

CHAPTER X

Hosiery

In England, where knitting started, "hosiery," as a technical term, includes all knit fabrics, but in the shops there, as well as in our stores, hosiery means stockings and socks.

The increased wages of the war and post-war periods, together with the vogue for sport styles, have increased the demand by men for silk socks and novelty stockings. The same two factors, together with the fashion for short skirts and bright colors, have taken women's stockings out of the class of staple merchandise where durability and fast color were the chief requisites. Now style is an important influence, and hosiery is bought for an occasion, or for a costume, instead of just to replenish the wardrobe. The demand for light shades, for silk, for lisle, for wool, for fancy patterns, for chiffon texture, keeps the mills busy meeting the desires of fashion's followers.

We can apply to hosiery the material given in previous chapters—the description of the methods of manufacture of the various knitting yarns, the statement of their qualities, and the explanation of the chief facts with regard to knitting machines, knitting processes and knit fabrics.

Education of the Hosiery Buyer.—While the fashion magazines tell what kind of hosiery is being worn, the

The narrowing which characterizes the leg of a full fashioned stocking

Left—Full fashioned stockings are shaped in knitting. Right—Circular knit stockings must be "boarded" to shape

manufacturers are trying to create an intelligent demand for stockings that will be durable as well as stylish. This effort is shown in trade names implying durability, in slogans assuring service, and in magazine advertising emphasizing wearing qualities. As a result, though the customer may examine the fabric for flaws, if she wants durability, she depends on a trademark of proved worth or on the advice of a dependable store.

The salesman sent out by the manufacturers are being equipped not only with samples but with accurate technical information on such matters as gauge, strand, loading and reinforcement. The manufacturers put out literature emphasizing the characteristics that make good-looking, durable hosiery. Although in many cases the "unconditional guarantee" has been withdrawn, manufacturers still stand back of their product, as do the retailers who "guarantee satisfaction."

Materials for Stockings.—These fabrics have been discussed at length in the chapters on yarns for knitting. A short summary of the qualities of the various yarns used in hosiery is given here.

Cotton.—Cotton is low-priced; it is absorbent and soft. It makes inexpensive hosiery which is particularly comfortable for those who have to be on their feet. In white, it can be boiled—a good feature in children's stockings.

Because the cotton fiber is short, cotton stockings show a fuzzy surface and cloudy texture.

Lisle Thread.—Lisle thread is the name of the best cotton yarn used in knitting. It is made of the best cotton; the fibers are combed until they are parallel; at

least two yarns are twisted together (two ply); the projecting fiber ends are singed off. All of this treatment tends to make a texture almost as clear and smooth as silk. A hard twist increases the strength (but it also increases the tendency to drop stitch). A lisle sole, because of the hard twist, is not as comfortable as one made with ordinary cotton yarn.

Mercerized lisle resembles silk in luster. (The term silk lisle should not be used.)

Price of Cotton Stockings.—The price of a pair of cotton stockings varies at present from 10 cents to $3.50. The higher cost is due to:

(a) The kind of yarn used—sometimes the "rider" (label at the top of the stockings) or the box label will show that high-grade cotton, Sea Island or Egyptian, was used. The fact that the cotton was combed, mercerized, and twisted into lisle thread, makes a higher-priced stocking. Chiffon weight costs more than heavy weight.

(b) Dye. Good dyes are expensive. Sometimes the rider emphasizes the quality of the dye.

(c) Gauge. A high gauge (42) is finer knit, uses a finer yarn, is better looking and higher priced than a coarse, low-gauge stocking.

(d) Shape. Full-fashioned stockings cost more than circular knit. They look better and hold their shape better.

(e) Novelty stockings require machine adjustments and so cost more than staple styles.

Wool.—Because wool is elastic and absorbs moisture, wool hosiery is desirable for outdoor use. Wool hosiery

is warm. Wool stockings may be woolen, worsted, mixed (with cotton, silk or rayon), or plated.

Woolen yarn is spun out of short wool fibers which are mixed in such a way that they lie in every direction. It makes a soft-feeling, comfortable stocking. If too short fibers (shoddy) are used, the yarn is not strong.

Worsted yarn is spun out of wool which is long enough to be combed until the fibers are parallel. It makes a clear-textured stocking. Though higher priced than woolen hosiery, worsted is usually more durable. Cashmere is a name given to a worsted hosiery which has been given a soft woolen finish.

Price of Wool Stockings.—The price of wool hosiery depends on the amount of wool present, the quality of the wool, and on whether it is woolen or worsted. Novelty effects increase the price. Low-priced wool hosiery may contain cotton or shoddy.

Silk.—Silk is strong as well as beautiful. It is so much more expensive than the other fibers that silk stockings are made light in weight. Silk can be saved by using lisle in the sole and at the top of the stocking and at the heel for reinforcement; silk stockings with a lisle top are known as "boot silk." The lisle top varies in depth.

Thread silk is considered to be better than spun silk.

Dyeing Silk Stockings.—Sometimes the silk for stockings is dyed before knitting. Such stockings are called ingrain. Skein dyed silk is hard to handle, so ingrain stockings are more expensive than silk stockings dyed after knitting. Ingrain stockings are particularly lustrous. They are marked by a white or colored thread in the heel and toe.

When silk stockings are dyed after they are knit they are called dip dyed. This method of dyeing permits the manufacturer to knit up stock and dye it as the demand requires. The proportion of dip dyed stockings to ingrain is increasing.

Pure Dye Silk Hosiery.—This term is used to indicate that metallic loading has not been added. Weighting makes a silk stocking feel heavier, but is so liable to injure the fabric that dealers are careful not to let this type of stocking stay long in stock.

It is quite easy to weight ingrain silk as it is being dyed, so one suspects weighting when one sees the white thread in the heel and toe—unless the label gives assurance that the stocking is pure dye. Dip-dye hosiery is sometimes weighted.

Price of Silk Stockings.—Many "bargains" in silk stockings are advertised. While the low price may be due to some unusual opportunity which a manufacturer gives the store, it is noticeable that the brand (except in the case of seconds) is seldom given. Other factors which account for a low price are listed below:

(1) Use of low-grade silk—grand double extra is the best. Use of spun silk instead of thread silk. The "rider" may give information on these points.

(2) Economy in the use of silk.
   (a) "Boot silk" instead of all silk.
   (b) Heel reinforced with lisle instead of silk.

(3) Cloudy texture.

(4) Fashioned shape instead of full-fashioned.

(5) Low gauge (less than 42).

(6) Off color or style.

(7) Weighting.

(8) Seconds—this is usually stated.

Rayon.—This fiber is used as a substitute for silk, as it has the luster of silk but costs less. Some of the rayon used in hosiery is being advertised under special trade names. Rayon is more absorbent than silk. When used alone, the stocking is liable to be coarse in gauge.

Combinations.—Combinations of fibers may be used for economy or to produce some particular effect. Combinations may be made by blending the fibers, by twisting different yarns together, and by plating.

Size of the Stocking.—The size of stocking chosen affects its appearance, its durability, and also the wearer's comfort. Proper size means a foot of proper length and proper width. The size required for adults can be *estimated:*

(1) By the size of the shoe, using the following table:

Size 1 shoe takes a size 8 stocking.
Size 2 or 3 shoe takes a size 8½ stocking.
Size 4 shoe takes a size 9 stocking.
Size 5 shoe takes a size 9½ stocking.
Size 6 shoe takes a size 10 stocking.
Size 7 shoe takes a size 10½ stocking.

Since some people buy a long, narrow shoe, this method is not always reliable.

(2) By laying the foot of the stocking around the closed hand—if the ends meet easily the size is suitable.

(3) For little children, the size can be estimated by the age. For obvious reasons this is not an accurate method.

An *accurate* method of determining the proper size

of hose for men, women, and children consists of measuring the length of the foot in inches. A foot ten inches long takes a 10 stocking.

Having determined the required size by any of these four methods, it is well to measure the foot of the stocking to insure that the No. 10 stocking is ten inches long.

There seems to be no stocking made especially designed for the very narrow foot and very slender ankle. Sometimes a brand "runs narrow"; sometimes individual pairs are narrower than ordinary. Sometimes narrow stockings can be found classed with "irregulars" and "seconds."

Stocking Length.—New standards of hose measurements—offered by Bureau of Standards:

"Method of measuring length of ladies' hosiery—Lay the hosiery on a flat surface. Place a ruler so that it touches the lower end of the heel gore and the curve formed at the ankle. The length is the distance from the bottom of the heel to the top of the hosiery as located by this line. (For full-fashioned hosiery this line of length may be determined by laying the ruler so that it touches the curve at the ankle and is parallel to the front line of the hosiery.)

"Method of measuring men's, children's, children's three-quarter length hosiery, infants' hosiery, and infants' socks—Lay the hosiery (or sock) on a flat surface. Place a ruler so that it passes through the heel gore and is parallel to the ribs on the ribbed portion of the hosiery. If the hosiery has been boarded properly, the ruler will be parallel to the front line of the hosiery."

The proposed standards are as follows:

Kind and Style	Size	Proposed Standard Lengths (Inches)
Ladies'	All	27½
Men's	9, 9½, 10	14
	10½, 11	
	11½, 12	14½
Children's and misses' ribbed	5, 5½	15
	6, 6½	17½
	7, 7½	20½
	8, 8½	23½
	9, 9½, 10	26½
Infants' ribbed	3, 3½	8
	4, 4½	12
	5, 5½	14
	6, 6½	15
	4, 4½	7½
	5, 5½	8
Infants' and children's socks	6, 6½	8½
	7, 7½	9½
	8, 8½	10
	9, 9½	10½

Stockings for the very short woman and the very tall woman will still be made. One manufacturer packs three lengths in a box, one being the standard length.

Outsizes.—The woman with a leg which is particularly large (more than eighteen inches round) should buy an outside instead of a "regular" size. The foot of a No. 10 outside is the same as the foot of a No. 10 regular size but the leg is knit on a larger machine. Sometimes a ribbed top is used; in this case one must be sure that there is sufficient elasticity where the top and leg join.

Stockings for Children.—These hose are usually made of a durable ribbed cotton fabric which is thicker and more elastic and therefore stronger than plain knit and does not drop stitch as easily. Long stockings for children are often reinforced at the knee.

Full-Fashioned Hosiery.—This phrase is applied to any hosiery which has been knit on a flat frame and shaped in the knitting. It shows "fashion marks" just below the hem and near the back seam.

(1) French foot. Most of our full-fashioned hosiery is made with the French foot, in which the back seam continues down the center of the sole. Fashion marks show in front of the heel and near the toe.

(2) English foot. This has a seam on each side of the foot and no seam in the center of the sole. It is found in this country chiefly in sport hosiery imported from England.

Full-fashioned hosiery is made for both men and women. Most high-priced novelties are made on the flat machine—that is, they are full-fashioned.

Circular Knit Hosiery.—This kind of hosiery is made on the circular machine. The stockings are made more quickly and require only joining across the toes to finish. These stockings cost less to make than full-fashioned stockings. This method is used in making children's stockings, men's socks and lower-priced women's hosiery.

These stockings are sometimes called "seamless" because they are knit without a seam; women's stockings, however, are usually finished with a seam which extends from the hem to the heel. This is known as a "mock seam."

Shaping Circular Knit Hosiery.—In order to shape a circular knit stocking, the wet tube-like knit fabric is placed on a metal form. The form is heated and the stocking dries in the desired shape. The process may be compared to the one used in drying little children's

stockings at home. The shape thus given is lost after the first washing.

There are, however, two methods in use which give a permanent shaping to circular knit hosiery. One is a machine which automatically drops out a number of stitches when the ankle is being knit, thus narrowing the stocking at that part. The most common method is one in which the tension on the knitting yarn is tightened so that smaller loops result. The number of loops in a row around the ankle is the same as in a row near the top of the stocking, but there is a larger number of loops per inch in a row near the ankle than in a row at the top. A stocking knit in this way shows finer closer knitting as the web is shaped for the ankle. Such stockings are often known as "fashioned" to distinguish them from seamless and full-fashioned makes. But the use of the term "fashioned" in connection with anything but full-fashioned hosiery has been condemned by the Better Business Bureau as tending to cause confusion and deception.

In order to imitate full-fashioned stockings "mock fashion marks" are knit in the back of circular knit hose, and these stockings are seamed from the hem to the heel. Such a stocking shows no seam in the hem and heel. It is finished by boarding. Sometimes a full-fashioned foot is added to a circular knit top, thus giving the foot a permanent shape.

Glove Silk Hosiery.—The manufacture of this kind of stocking and its qualities were discussed in the chapter on warp knitting.

Rib Knit Stockings.—Rib knitting is used to give elasticity, thickness and durability to children's stock-

ings. Rib knitting is being used for women's and men's sport wear hosiery for the same reasons. Many rib knit stockings are not shaped in knitting and appeal because of their low price. In buying ribbed stockings or lace striped or Richelieu ribbed (drop stitch) there are two points to remember:

(1) Ribs and lace stripes do *not* make the ankle smaller.

(2) The ribs in low-priced stockings often stop at the ankle, making a bad line with low shoes.

Clocks and Other Decorations.—These are decorations on the sides of stockings. It is said that they were introduced in the first place to cover up a seam.

Clocks may be embroidered by hand or by machine. Lace clocks may be made in the knitting process (Paris clocks), or they may be made by a process similar to drawn thread work; that is, threads may be dropped, forming a ladder which can be hemstitched on both sides.

Clocks should branch at the lower end. In low-priced stockings this is sometimes not the case, and the poor workmanship shows when the stocking is worn with low shoes.

Embroidery may be used on other parts of the stocking. Lace may be inset.

The Welt.—This is the technical name for the hem used on women's hosiery. In the best stockings it is made as the stockings are made; that is, a piece wide enough for the hem is knit; this is turned back the width of the hem and its first loops are caught in with those now on the machine. This device avoids the necessity for sewing and also makes the garter run stop.

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The welt on a full-fashioned stocking has an opening on the inside at the back seam. This gives increased elasticity.

Low-priced stockings have a machine-sewn hem. This process may cut the stitches and weaken the knit fabric. Ribbed stockings usually have no hem.

The hem is designed to serve as a finish and also as a safe place to fasten stocking supporters.

Choice of Stockings.—When stockings are chosen for style, then color, material and design are important factors. Other factors which influence choice are the desire for durability, comfort or a certain price.

Durability means not only that the stocking does not wear out readily, but that it does not drop stitch easily. Lisle, silk and rayon drop stitch easily. Cotton and wool do not drop stitch so easily. Close knitting (fine gauge) and heavy yarns decrease the tendency to drop stitch and increase durability. Reinforcement of heels and soles adds to the wear. Rigid inspection of the back seam, particularly at the heel, has decreased a weakness at that place.

Frequent washing of all stockings removes the grit which is so liable to make stockings wear out. It also removes perspiration which weakens stockings with all-silk soles and heels. Heel protectors in shoes also save the heels of stockings.

Buying two pairs of stockings of one kind at a time is an economy; for, if an accident happens to one stocking, its mate can still be used to pair with either of the others when needed.

A hosiery repair service can be had through your dealer, or direct. It takes care of runs, mending them invisibly for a very low price.

Careless putting on of stockings is often the cause of breaks, runs or tears. One company recommends the following:

In putting on a fine silk stocking, always turn the hose inside out down to the heel, straightening the foot of the stocking with the hand. Insert the toes and fit the heel. Work the leg of the stocking up onto the foot until the top is even with the toes. Turn the top right side out and draw the stocking gently over the heel. The foot is now snugly fitted and the stocking proper is loose around the ankle. Insert the thumbs inside the stocking. Then draw it up over the leg, releasing the folds from the fingers. In removing a stocking, use a reverse method, drawing the stocking off from top to toe.

Summary.—Technical terms used:

boarding	glove silk	seamless
boot silk	ingrain	pure dye
chiffon	lisle	semi-fashioned
circular knit	loading	singeing
clocks	mercerized	splicing
combed	mock fashioning	spun silk
dip dye	mock seam	strand (12)
English foot	outsize	thread silk
fashion marks	plated	twist (to inch)
French foot	ply yarn	woolen yarn
full-fashioned	rayon	worsted yarn
garter-run-stop	reinforcement	weighted
gassing	ribbed	welt
gauge	rider	

Review and Merchandise Applications.—(1) Give some hosiery trade names which imply durability; some hosiery slogans.

(2) Clip some hosiery advertisements, both of manufacturer and of dealer, which emphasize durability.

(3) What is the range in price in cotton stockings? Compare the highest priced with the lowest priced, using as many of the factors given in paragraph 6 as possible.

(4) Do you know anyone who wears lisle stockings? Why are they chosen?

(5) Do you know any adult who wears cotton stockings? Why are they chosen?

(6) Could you tell by examination whether stockings were lisle or just cotton? How?

(7) Could you tell by examination whether stockings were mercerized? How?

(8) What disadvantages in cotton stockings?

(9) What disadvantages in wool stockings?

(10) How does the price of woolen and worsted hosiery compare? What disadvantages in worsted hosiery (as compared with woolen)?

(11) Compare woolen and worsted yarn as to kind of wool used, manufacturing processes required and appearance of product.

(12) What is the highest-priced wool stocking? What factors account for the price?

(13) What advantage in using cotton with wool for hosiery?

(14) Can you find any wool plated hosiery? How does the plating show?

(15) What disadvantages in silk stockings?

(16) What two trade names indicate two different times of dyeing silk stockings?

(17) What does a white thread at the heel and toe indicate?

(18) Find a hosiery advertisement or rider using the phrase "thread silk." What does it mean?

(19) Determine whether ingrain stockings are more or less expensive than dip-dye. Explain the answer.

(20) Do you know anyone who chooses ingrain hosiery? Why?

(21) Do you know anyone who will not buy ingrain hosiery? Why?

(22) What is the opposite term to pure dye?

(23) Find the highest priced silk stocking. What factors account for the price?

(24) What other words are used instead of rayon?

(25) Do you know anyone who chooses rayon hosiery? Why?

(26) What size stocking should you wear according to the table of shoe sizes?

(27) What size stocking do you buy? What is the length of your foot? What is the length of the foot of the stocking you are wearing? How long is the leg of your stocking? Is it satisfactory?

(28) Some women think "full-fashioned" means "out-size." What is the difference?

(29) In what four places are fashion marks found in full-fashioned hosiery?

(30) Suppose you were sitting on a side seat in a car, could you tell whether the stockings you saw were cotton, lisle, woolen, worsted, silk or rayon? If so, how in each case? Could you tell whether they were full-fashioned or seamless? How?

(31) Do you know any woman who chooses a seamless stocking instead of full-fashioned? Why?

(32) Clip advertisements in which trade terms indicating quality are used.

THE END

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